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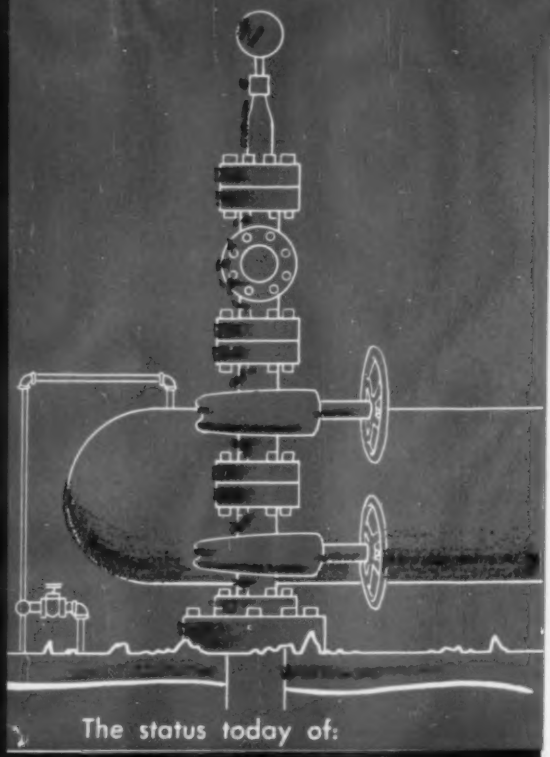
the OIL AND GAS JOURNAL

MARCH 23, 1959

EXPLORATION ▸ 139
STATISTICS ▸ 160



The status today of:

Miscible Phase Drives

Here's the box score on today's projects, plus some things oil men are learning about this new technique. ▸ 64

Reserves bounce back, hit new peak ▸ 49

Davis sees 70 billion more barrels in 20 years ▸ 51

UOP reveals a new refining process ▸ 52

Lower replacement cost makes Rockies attractive ▸ 54

New company import quotas ▸ 56

Liquid methane: a cheaper means of peak shaving? ▸ 75

Sharpshooting by directional drilling ▸ 86

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DUNCAN, OKLAHOMA

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
March 23, 1959

Long-range outlook is bullish for domestic oil:

Latest estimates show good increase in reserves of crude, natural-gas liquids, and natural gas last year.

API's figures (p. 49) show this scoreboard:

...Crude reserves of 30.5 billion barrels, up 235.5 million barrels from 1957.

...Natural-gas liquids of 6.2 billion barrels, a gain of 516.6 million barrels.

...Natural gas of 254 trillion cubic feet, up 7.5 trillion cubic feet.

Gains put reserves at all-time highs and compensated for declines in 1957. Bulk of increase came from revisions of previous estimates and extension of old pools.

Two other long-range predictions:

Humble's Morgan Davis tells AAPG the industry will add 70 billion barrels to its reserves in next 20 years. He's optimistic about the prospects (p. 51).

Bureau of Mines estimates industry eventually will produce 240 billion more barrels of crude with 210 billion barrels still to be found.

▼ ▼ ▼

Look for more trouble in Iraq.

The Arab world's popular leader, Gamal Abel Nasser, is trying to whip up a holy war against Iraq's premier Karim Kassem. Nasser also accuses Russia of imperialistic moves in the Middle East.

Kassem for his part is blaming Nasser for fomenting the recent bloody revolt. Kassem has reached an economic aid pact with Russia on whom he is leaning more and more for support.

Stakes in struggle are big. Iraq has nearly 800,000 bbl. daily of crude production and is in a strategic geographical position. Roots of trouble also lie deep. Cairo and Baghdad for hundreds of years have vied for Arab leadership.

▼ ▼ ▼

Active rotary rigs are still rising gradually.

They averaged 1,895 last week, up 141 from the year's low of 1,781 on February 2.

Active rigs were dropping last year over this same period and reached the year's low on March 17. In fact, activity

didn't reach 1,900 rigs until middle of August.

With weather improving now, rig activity should show even more strength.

▼ ▼ ▼

Two Texas wildcats stir some interest.

Shell's 1 Conley in southeastern Hardeman County looks like an oil discovery on extreme southeastern tip of little explored Palo Duro basin. Test flowed 148 bbl. of oil after acid treatment of Chappel limestone at 7,800-8,008 ft.

Humble is starting a 15,000-ft. Ellenburger test of the huge Pandale anticline structure in a remote northwestern part of Val Verde County. It steps out on structural trend 10 miles southeast from prolific Brown-Bassett area.

Geologists now predict Brown-Bassett will exceed Puckett field in size and equal it in caliber of gas reserves. Limits are not yet known.

Puckett is 8 miles long, 4 miles wide with closure of about 2,000 ft. It produces gas from both Devonian and Ellenburger with some of the largest gas wells in the world.

Best place in interior U. S. to look for oil still is the Rocky Mountain region.

Carter study shows why: Operator gets an average $2.83 per bbl. for oil that costs $1.73 to replace. In Michigan and Illinois he gets $3.14 for oil costing $3.76 to replace and in Oklahoma and Kansas the price is $3.02 and costs $2.86.

Another startling fact the study turned up: The oil industry has spent more money since 1950 than it has taken in from sale of crude and natural gas. (p. 54)

▼ ▼ ▼

Promising method of increasing fracturing efficiency is being examined by the Western Company.

Dry crystals of sulfamic acid are included in the fracturing fluid. Thus benefits of the fracture job are augmented by an acidizing effect over a long period of time, since the crystals dissolve slowly in the formation waters.

Treatment is good only in acid-soluble rocks. It has been successfully used in one well in the Permian basin. In 5 months well still was producing 90 bbl. daily. Untreated offset wells were making 15 bbl. daily.

Miscible drive is coming of age as recovery tool.

A Journal study reveals 39 projects operating or planned in eight states. The number is growing fast. Early results show there is still plenty to learn and one big problem is how to increase areal sweep efficiency.

Six projects have failed, but oil men still are enthusiastic about the future of the method. The successful projects are turning up valuable data to guide operators in planning future projects (p. 64).

Specific import quotas now give companies better idea what life will be like under new controls.

Some 136 refiners got quotas including 76 which had no allotments under voluntary program. Five which had quotas under former program got none this time because they aren't refiners.

Some of established importers got sharp cutbacks. Hardest hit were those bringing in more unfinished products than oil. (p. 56).

▼ ▼ ▼

Expansion of its products line north from Enid, Okla., to Superior, Neb., is being considered by Champlin Refining.

Shipments through the line the last 3 months of 1958 averaged 11,200 bbl. daily—close to peak capacity.

Experiment in gasifying coal underground is being abandoned by the Bureau of Mines. Study was made at Gorgas, Ala., in cooperation with Alabama Power Co.

The test, according to Mines Chief Ankeny, shows this: A large technological breakthrough will be necessary before gas production from coal will be economical. Costs are too high.

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Changing trends in refinery investments are revealed in 10-year study by a major oil company.

Study shows gross investment in fixed assets for refining up 120% in 10 years. But refining capacity only increased by 19%, rest of spending went for upgrading facilities.

Daily capacity over a 6-year period rose from 91 bbl. per day per man to 130 bbl. Company estimates it still must do 10 to 20% better if it is to grow and prosper.

Two molecular-sieve processes upgrading gasoline stocks are now available to refiners (p. 52).

Molex process was introduced by UOP last week at WPRA meeting. Its advantages: Single treatment sufficient to remove normal paraffins...Continuous processing possible...And only a minimum of utilities are needed.

Texaco's selective finishing process was announced last fall. It upgrades gasoline by removing the low-octane-number straight-chain hydrocarbons.

Want to avoid energy losses occurring in processing when it's necessary to lower the pressure of a stream? Then take a look at the overall plant power needs. You may be able to put the lost energy to work.

La Gloria's natural-gasoline plant at Falfurrias has added 9,000 hp. in the last 18 months. But 6,000 hp. of this was provided when high-pressure oil and gas streams were used to drive pumps and compressors.

Alkylation capacity stands a good chance of topping the 400,000-bbl. daily mark this year.

Capacity at start of year was 370,000 bbl. with about 23,500 bbl. daily more scheduled for completion before year is out. Add capacity in chemical plants—6,000 bbl. operated by Texas Butadiene & Chemical and 3,000 bbl. scheduled to go on stream for Petro-Tex—and the 400,000 bbl. mark is sure to be crowded.

▼ ▼ ▼

Jet fuels of the future may be tailor made from saturated polycyclics, edging out paraffins and aromatics. That's the prediction of J. B. McCauley, deputy director of defense research and engineering.

The reason: Saturated polycyclics offer the best thermal stability of the three hydrocarbon groups.

This tendency of jet fuels to break down at high operating temperatures of supersonic craft is a big stumbling block yet to be whipped.

Here's a switch on octanes.

Military specs soon may call for a top 91 research octane number for motor gasoline. It will tie in with the advent of multifuel, compression-ignition engines.

Such an engine is in the cards. The military wants one which could use gasoline, jet fuel, or diesel fuel indiscriminately as well as captured fuels of these types. Fuels of high antiknock quality don't perform well in such engines, hence the possible octane ceiling.

Refiners should not be lulled by the slight decline in the weighted average compression ratios of 1959 car models.

Octane requirements of total car population continue to rise. This is due to scrapping of older, low-requirement cars plus higher requirements of new cars arising from leaner gas mixtures and other factors independent of compression ratio.

▼ ▼ ▼

Company notes:

Continental has created a director of public affairs, put Harold S. Skinner in charge. His Job: Help individual members of Conoco's management make their influence felt on all issues that threaten company's or industry's best interests.

The Texas Co. probably will change name to Texaco. Suggestion will be considered at next stockholders meeting.

Union Oil of California is backing off its price slash in California and Four Corners. Reason: "Anticipated changes in petroleum supply and demand" which means the domestic outlook suddenly changed with the new imports plan. Union will have new postings out by April 1.

Shell has a good well in Libya, 170 miles west of Tripoli at Bir Tlacsin. Short-open hole test indicates it may be good for 1,000 bbl. daily.

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Good Wells Make Good News

A Monthly Report on Wells That Are Now Worth More

March 23, 1959

In each of these frac jobs by Dowell, the treatment was especially designed for unusual well conditions. In each case, results were remarkably successful.

- **Sweetwater County, Wyoming** (Old Oil Well) The pay was an open hole section of the Tensleep sand from 5267 to 5575 feet. Production had dropped from 285 bopd to 110 bopd. Operator ordered Petrojel*, and Dowell injected 30,000 gallons gelled crude and 30,000 pounds sand. 1025 gallons of the temporary plugging agent used in Fixafrac* were injected at mid-treatment. During fracturing, pressures ranged up to 4400 psi and injection rates up to 20 bpm. After treatment, production leveled off at 270 bopd. The entire cost of treatment, including cost of running three-inch tubing, was paid out in slightly over one month.

- **Northeast British Columbia, Canada** (New Oil Well) Perforations into the Triassic sandy lime were from 4251 to 4272 feet. In spite of 95 per cent acid solubility, acid treatments in this formation had failed because spent acid would not come back. Fracturing was difficult because the crude oil had one of the worst emulsifying characteristics of any oil ever tested. Dowell tests indicated that satisfactory results might be expected if a demulsifying agent and F.L.A.* (Fluid Loss Additive) were used. The operator ordered Sandfrac*. Dowell injected 20,000 gallons modified lease crude with 20,000 pounds sand down casing at 15 bpm. Well had been producing 65 bopd. After treatment, production was 115 bopd. Payout was only two months in a field where payouts were notoriously slow.

- **Ochiltree County, Texas Panhandle** (New Oil Well) Casing perforations into the upper Morrow sand were from 7510 to 7522 feet. Dowell tests on samples of the formation and produced fluid indicated use of BDA* (Breakdown Acid) and Sandfrac. 750 gallons BDA were injected to break down formation and remove drilling mud. After clean-up, well made 5 boph on test. Then another 500 gallons BDA were injected as a spearhead. This was followed by 480 barrels lease crude and 29,000 pounds sand. Injection rate was 38.2 bpm with pressures ranging from 2250 to 2800 psi. After the well was cleaned up, it tested 394 bopd.

- **Seminole County, Oklahoma** (New Oil Well) This well was completed through perforations into the Earlsboro sand from 3294 to 3332 feet. Operator wanted a low cost fracturing job so he ordered Sandfrac. Dowell injected 4000 gallons refined oil and 8000 pounds of sand. Fifty ball sealers were injected during treatment to improve fracture pattern. Injection was down tubing at 5 bpm and 2000 psi. This well originally tested 1½ bopd. After clean-up, it tested 150 bopd through a ¼-inch choke.

Whether your stimulation problem is unusual or routine, call your Dowell representative. He can help you select a treatment designed especially for your well. For detailed information or prompt service, call the Dowell engineer in your area. In Canada, call Dowell of Canada, Ltd.; in Venezuela, United Oilwell Service. Dowell, Tulsa 1, Oklahoma.

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TECHNOLOGY–OPERATION

Refining-Processing

Liquid Methane . . . A Cheaper Means of Peak Shaving? 75

By A. Russell Young

Design data, investment, and operating costs are developed from fully engineered, large-scale plant designs prepared by J. F. Pritchard & Co. for Constock International Methane, Ltd. These costs are current, firm investment figures subject to a 5% maximum contingency factor. In using these costs, the annual average 7% increase experienced for this class of facilities must be allowed if the costs are used for future proposed investments.

Questions on Technology 102

Economical size of refineries depends more on the type of management than any other factor. Power for in-tank mixing. Sulfur in coke versus sulfur in parent crude oil.

WPRA Refining Quiz—5: Cat Cracking . . . 107

Here is the material developed on cat cracking at the latest El Dorado, Ark., regional meeting of Western Petroleum Refiners Association. This is the fifth and concluding portion of the transcript for the 2-day session.

Pipelining

Liquid Methane . . . A Cheaper Means of Peak Shaving? 75

By A. Russell Young

Here's How Bechtel Double-Joints Big Pipe 83

By Paul Reed

Bechtel Corp. has developed a completely automatic submerged arc-welding technique for double-jointing big pipe. The two new factors are: (1) the copper backup shoe protected by a woven-glass-fiber sleeve, and (2) a special friction disk clutch device for holding the pipe so as to relieve stress at the welding groove during rotation.

Drilling-Production

Sharpshooting by Directional Drilling 86

By D. H. Stormont

Developing an oil field that literally stands on end always requires pinpoint drilliag. This is accentuated when a thick producing section in which the water level varies from sand to sand is encountered. This is what Shell Oil Co. has found at Saticoy field near Santa Paula, California.

Denver Basin Water Flood Gives Fast Payout 88

By W. B. Bleakley

Recoveries are increased by about 50% and that's why new water floods are popping up everywhere in the Denver basin these days. It doesn't cost much to drill but wells are expensive because of the small amount of primary reserves.

Arc Gouging Torch Provides Welding Flexibility 90

New tool can cut maintenance cost.

Supply Stores May Have To Trim Services . . 92

By Ed McGhee

You never miss the water till the well runs dry. The oil industry probably won't realize the magnitude of the service it gets from its supply stores unless it should lose part of that service. While things are now looking up, there's still a real danger that supply companies will have to trim their pattern of service.

Metal Basket Aids Topside Work 100

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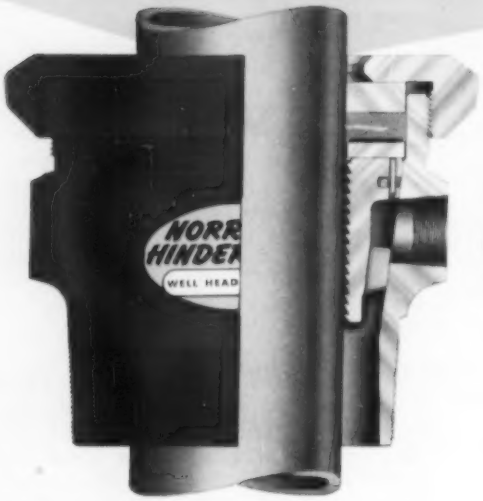

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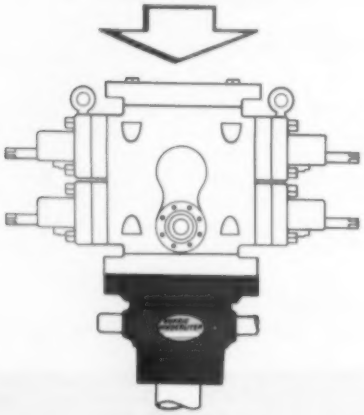

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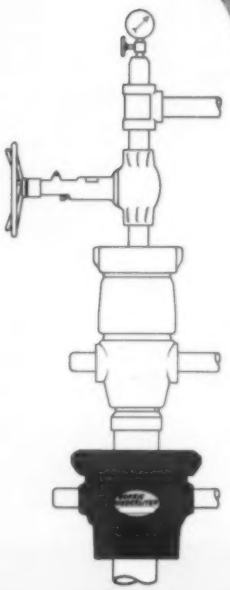

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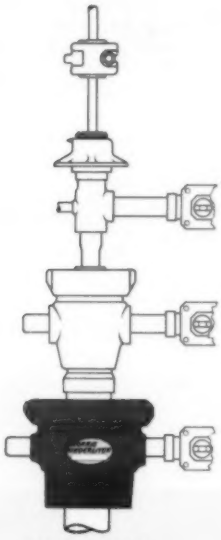

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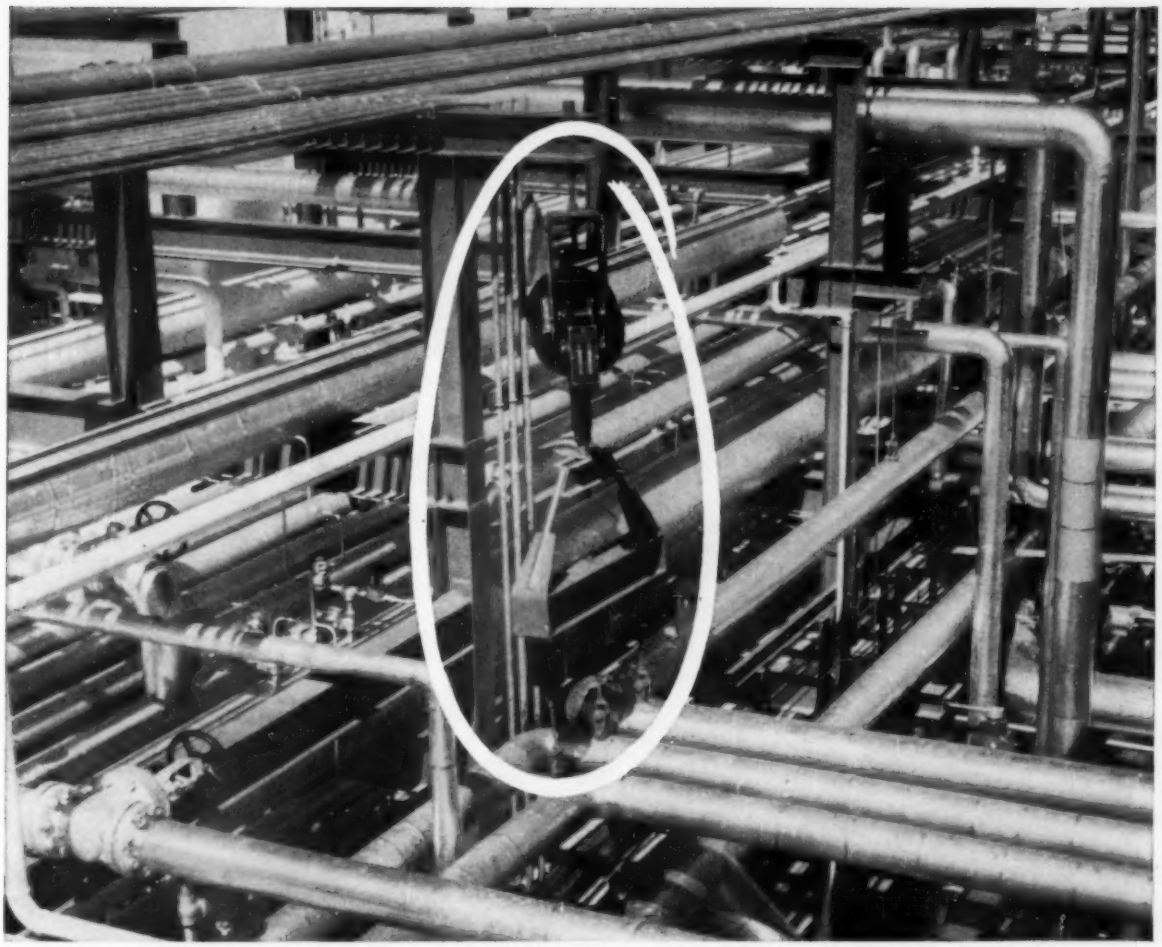

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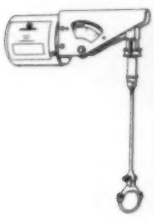

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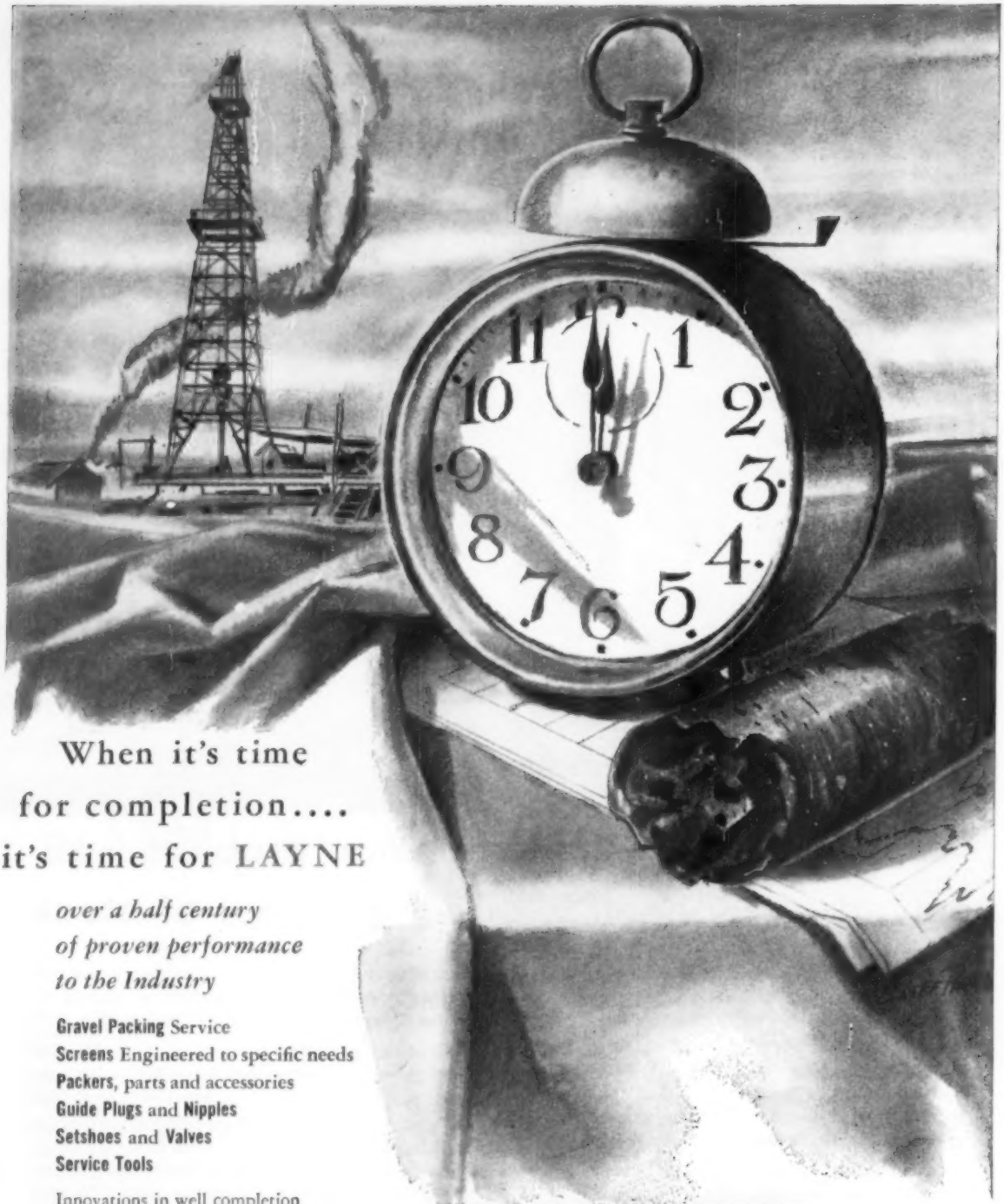

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SELF-ALIGNING ROLLER BEARINGS BY LINK-BELT

BIG, mirror-smooth convex rollers *plus* heavy, broad-shouldered inner race *plus* centrifugally-cast bronze, precision-machined retainers! Only from Link-Belt do you get ALL that is best in modern bearing design.

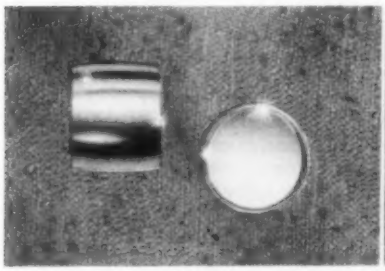
Individually, these elements represent major improvements on accepted design concepts. Collectively, they constitute the most efficient spherical roller bearings available . . . promise unequalled economies, whatever the application.

Your Link-Belt office or authorized stock-carrying distributor will gladly explain the many performance advantages evolved with this new design. And either can furnish full data on industry's most complete line of ball and roller bearings . . . pillow blocks and flanged, flanged-cartridge, cartridge and take-up blocks.

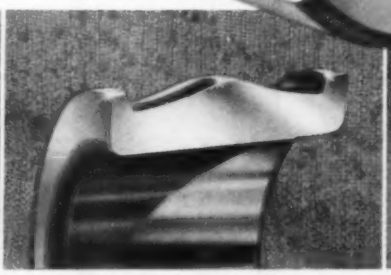
LINK-BELT

MANUFACTURERS OF SELF-ALIGNING BALL AND ROLLER BEARINGS

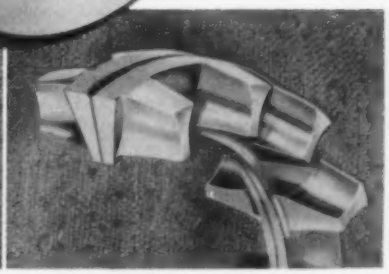
LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 26, Odessa, Tex., New Orleans 16, Shreveport, La., Los Angeles 22 (Montebello), Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields. 14,519-B



BIG, HIGHEST-CAPACITY ROLLERS. Each bearing has a maximum number of rollers —as large as possible, yet all components are in optimum balance.



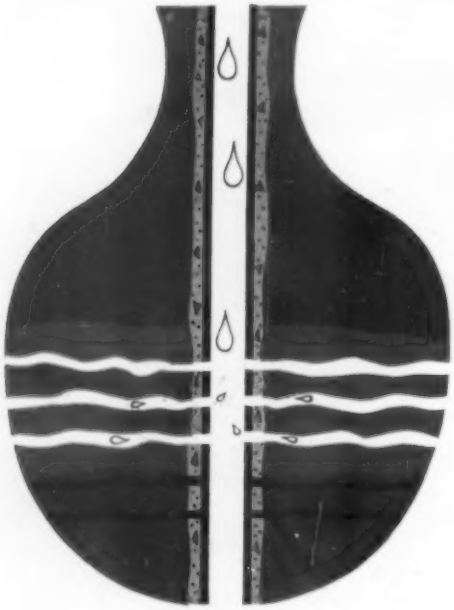
HIGH, HEAVY INNER RACE FLANGES present convenient hold for assembly and removal of bearing without cutting away shaft, avoid any need to skimp on shaft shoulders.



PRECISION-MACHINED, CENTRIFUGALLY-CAST BRONZE RETAINERS have many times more support and ability to withstand high stress. They are not stampings. Design assures maximum bearing efficiency.

NEW LIFE FOR YOUR WELL...

HALLIBURTON'S UNMATCHED ACIDIZING EXPERIENCE



If oil or gas is there, a Halliburton Acidizing Service will help you to maximum recovery.

In thousands of wells, Halliburton Acidizing Services have started new production and revived old production, by improving permeability, removing mud cake and breaking water and emulsion blocks.

Halliburton puts the industry's most effective chemical weapons against production barriers to work in your well, augmented by specifically designed, highly efficient tools. Experienced and trained field personnel, familiar with formation problems, skillfully apply these tools and chemicals for maximum recovery results.

Get all the benefits that only modern chemistry and physics can give to your well. Specify Halliburton... the world's most experienced service organization... for *your* acidizing needs!

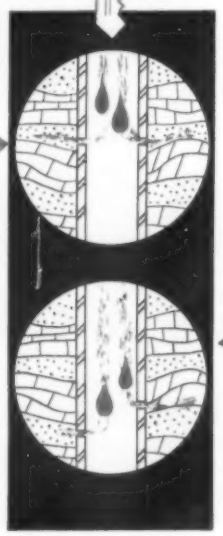
HALLIBURTON CHEMICALS AND TOOLS...

KEYS TO HELP OPEN LOCKED DEPOSITS OF OIL

HYDROCHLORIC ACID

Hydrochloric Acid is most effectively used in the treatment of limestone and dolomite formations to improve permeability. The reaction products are soluble, permitting the removal of the dissolved limestone or dolomite in the spent acid solution. Specific non-emulsifying agents are mixed with the acid, when necessary, to prevent the formation of viscous emulsions.

Hydrochloric Acid is also used as the base fluid of Halliburton Acidfrac and in conjunction with other fracturing services.



HALLIBURTON'S "HV" ACID

Halliburton's "HV" (High Viscosity) Acid inherently delays reaction until the solution is at a greater distance from the well bore, with a resulting larger well drainage area. A comparable volume of Halliburton's "HV" Acid may cover from 4 to 9 times the drainage area of ordinary acid. Extremely useful for temporarily plugging highly permeable sections of well bore in old wells or those previously acidized... which diverts following non-emulsifying acid to other zones... thus opening up new drainage channels.

Acid Formation Cleaner

HALLIBURTON ACID FORMATION CLEANER

A specially designed tool for use in washing potentially productive zones with fast-acting acid before testing, to minimize hole damage caused during the drilling process. Especially valuable in areas where zones of very low formation pressure can be blocked by mud filter cake alone.

HALLIBURTON MUD CLEANOUT AGENT (MCA)

Through the use of MCA, natural oil or gas flow channels may be re-opened, and on cement jobs, cement is more firmly bonded to formations. If normal permeability has been plugged by mud cake or if mud is lost in the formation crevices and flow channels, an exclusive chemical constituent in MCA aids in softening and dispersing the mud for easier removal.

HALLIBURTON "R-3" TREATING PACKER

A new economical—short—compact—retrievable tool used for treating, fracturing, water flooding, and producing a well. Is run into cased hole on tubing to aid in isolating a section to be treated and may be set and reset on one trip. Can be set in tension or compression without modification. Consists of a packer rubber, drag springs, mechanical type slips mounted in a sleeve, and a J-slot arrangement. Full opening mandrel permits passage of wireline type tools, instruments or perforating guns. Available in 4½", 5½" and 7" O. D. casing sizes.

"R-3" Treating Packer

HALLIBURTON "Fe" ACID

Primarily designed to help prevent abnormal amounts of dissolved iron from precipitating after the hydrochloric acid is spent. Holds dissolved iron in solution allowing ample time for easier removal from the well which could act as a plugging agent in permeable channels.

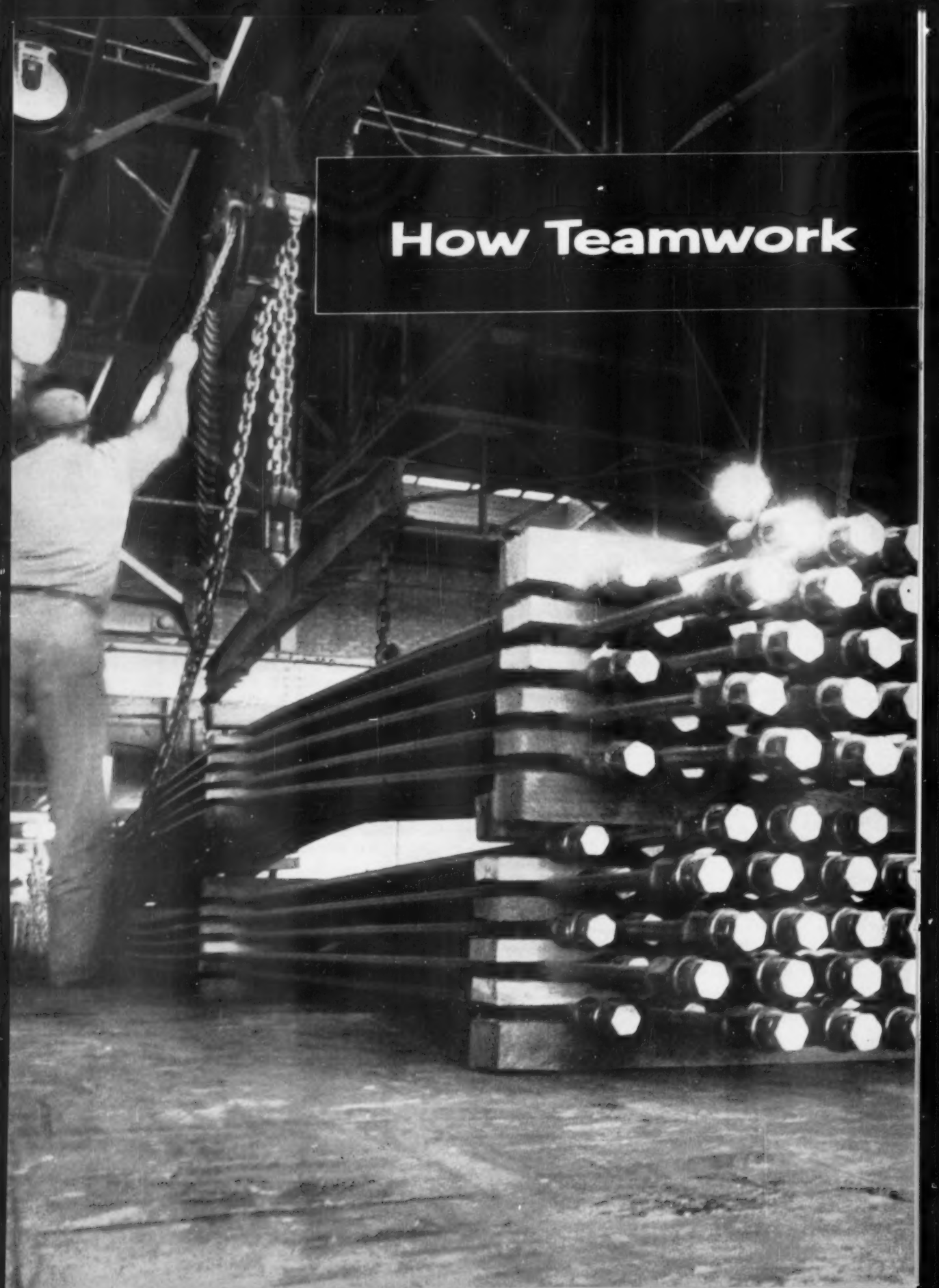
"Fe" Acid is more applicable to treatments in water flooding or disposal wells . . . used to remove accumulated iron from the water or after acid reaction with rusty pipe, and then deposited at or near the well bore as hydroxides or oxide mixtures . . . where it reduces the input of water at previous pressures.

Halliburton Acid Inhibitors contain no arsenic or metalo-organic compounds.

HALLIBURTON CHEMICAL SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY, DUNCAN, OKLAHOMA

NEW LIFE FOR YOUR WELL . . . WITH ACIDIZING


How Teamwork

Improves Rod Service

Here's how the J&L-Axelson team can help you get better sucker rod performance.

First, the experience and knowledge of the J&L man enables him to specify the correct size, type and grade of rods for the conditions in your well.

Second, the manufacturing skills developed by Axelson during sixty-six years in the business are your guarantee of uniform high quality. This means all the rods in an Axelson string do their share with no weak links to cause trouble now or later.

This brand of performance has made the J&L-Axelson team the standard for sucker rods throughout the oil fields of the United States and Canada.

Ask your local J&L Supply man for complete information on Axelson Sucker Rods or write us direct, Drawer 2481, Tulsa.

Jones & Laughlin

SUPPLY DIVISION – Tulsa

If it's sold by J&L....
It's the best available

57

FOR YOUR LIGHT WEIGHT DRILL PIPE . . .

ONE THIRD LIGHTER

than any other tool joint!

AMERICAN IRON OPEN-HOLE TOOL JOINTS

First and only tool joints designed specifically for use on light weight drill pipe and tubing.

Available in Straight-Grip Flash Welded and Bucked-on Types.

American Iron Open-Hole Flash Welded tool joints average 6% lighter weight than any other tool joint and light weight drill pipe combination.

Accurately controlled flash welding always insures bull's eye alignment and prolongs drill string life. It makes stabbing, make-up and break-out easier. Years of field proven quality are wrapped up for you in our Open-Hole Flash Welded connectors.

Light weight drill pipe helps you increase drilling profits by going deeper with the same drawworks. So, it's just good arithmetic to specify American Iron Open-Hole Flash Welded tool joints!

SEND NOW for Open-Hole Tool Joint Brochure containing detailed information and prices!

Available through your Supply Store

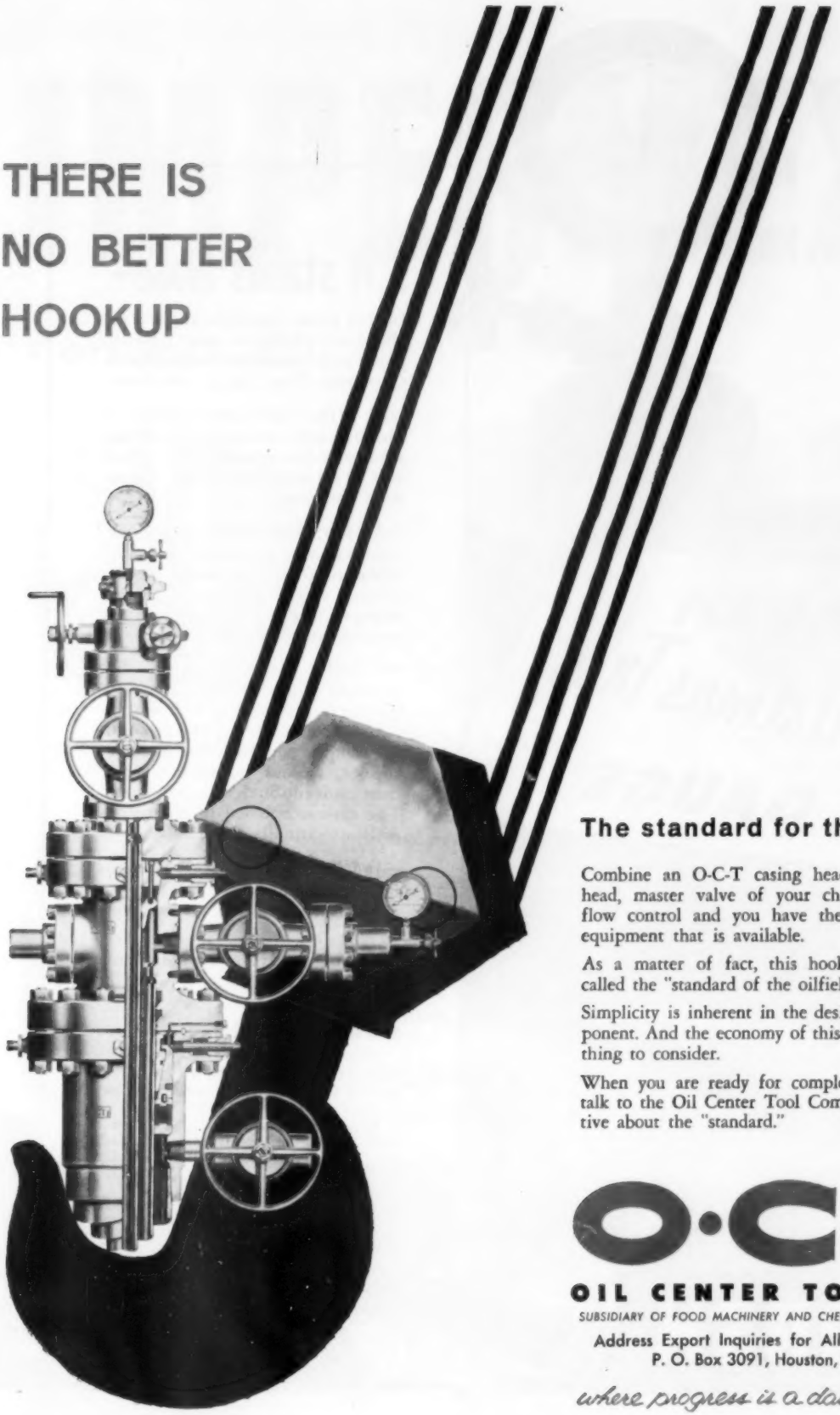
Another AMF Product
PETROLEUM EQUIPMENT

AMERICAN IRON & MACHINE WORKS COMPANY, INC.
518 North Indiana Avenue • Oklahoma City, Oklahoma
Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

36 Years' Experience in Designing and Manufacturing Oil Field Equipment.

AMERICAN IRON & MACHINE WORKS CO. INC. • OKLAHOMA CITY •

THERE IS NO BETTER HOOKUP



The standard for the oilfield

Combine an O-C-T casing head, O-C-T tubing head, master valve of your choice, and O-C-T flow control and you have the finest wellhead equipment that is available.

As a matter of fact, this hookup is rightfully called the "standard of the oilfield."

Simplicity is inherent in the design of each component. And the economy of this hookup is something to consider.

When you are ready for completion equipment, talk to the Oil Center Tool Company representative about the "standard."

O·C·T

OIL CENTER TOOL CO.

SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

Address Export Inquiries for All Countries to
P. O. Box 3091, Houston, Texas.

where progress is a daily practice

...it stands alone-

In this latest development we reaffirm our pledge to make a better gauge ever better. Only in the Marsh Christmas Tree Gauge you have:

—**A better tube construction**— bourdon tube and socket fused into a one piece permanently leak-proof unit by the exclusive Marsh "Conoweld" process.

—**A better movement**—all but frictionless as a result of the self-lubricating effect of unlike metals. Coined sector gear gives greater strength where greater strength is needed; also smoother operation.

—**A better case**—a copper-clad wrought steel case of boiler plate thickness, produced by the "Marsh-alloy" process. It has the strength of steel, the corrosion resistance of copper, and is one-third lighter than conventional cast-iron cases. The case is finished in corrosion-resistant satin black enamel.

—**the Marsh "Recalibrator"**—not only the handiest way to keep a gauge accurate; also the *best* way.

★ There is a Marsh Gauge for every oil country and refinery application. Ask your supply house or write for latest bulletins.

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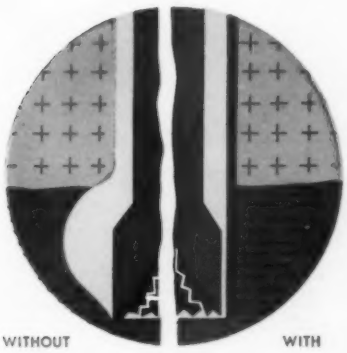
MARSH STOCKED by Your Local Supply Store **GAUGES**

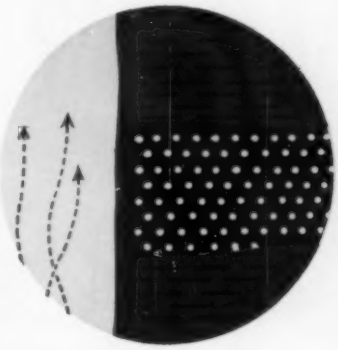
Seeing is believing . . .

IMPERMEX*

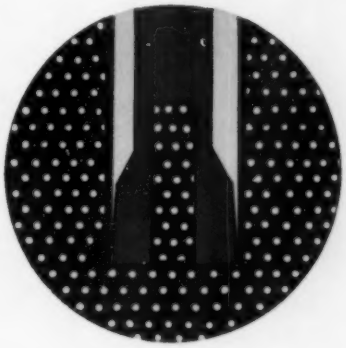
controls *mud filtration properties*



LESS HOLE TROUBLE



PROTECTS PRODUCTIVE ZONES



BETTER CORES AND DST'S

Write for complete technical data bulletin on use of IMPERMEX.

IMPERMEX . . . successfully used for years to control mud filtrate loss.

IMPERMEX . . . controls mud filtrate loss in the presence of all drilled and make-up water contaminants.

IMPERMEX . . . allows better coring and easier drill stem testing.

BAROID

BAROID DIVISION NATIONAL LEAD COMPANY

MAIN OFFICE: P. O. BOX 1675, HOUSTON 1, TEXAS

*Registered Trademark, Baroid Division National Lead Co.

5908

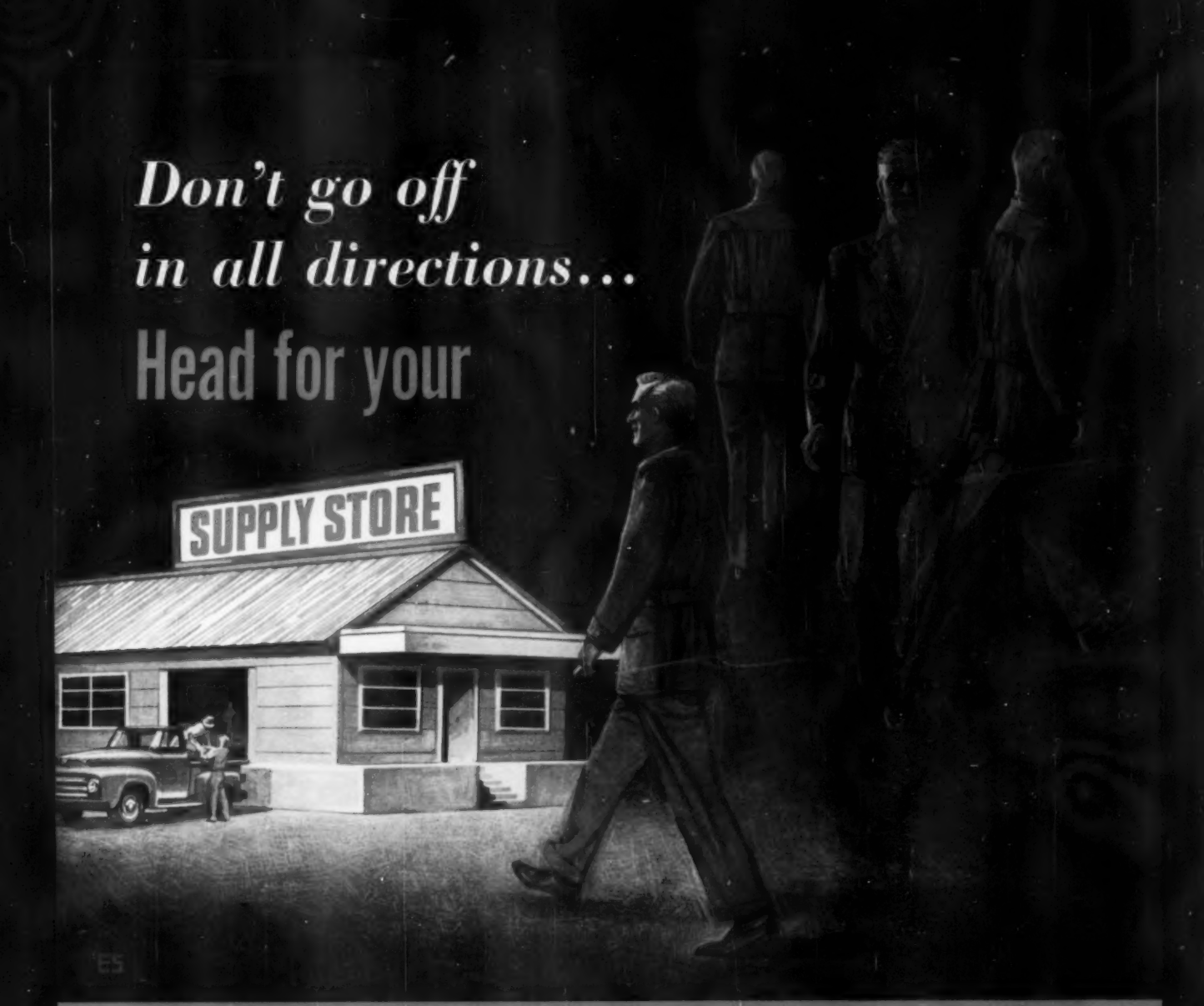
After 5,000 years of mud... superhighways of petroleum

▲ **YESTERDAY.** Muddy roads clutched at the world's wheels, slowing transportation to a worm's pace. Then at last, man found he could make smooth, hard-surfaced roads from asphalt — a non-volatile form of petroleum. In the early promotion of asphalt road-building, Texaco took a prominent part.

◀ **TODAY.** Texaco is one of the world's largest manufacturers of asphalt products. These products make possible great ribbons of smooth superhighways, as well as airport landing strips. They are used for roofing, battery boxes and many other useful items. Texaco's leadership and growth in this field result from its policy of constantly planning for the future. THE TEXAS COMPANY

TEXACO

... CONSTANT PROGRESS IN OIL'S FIRST CENTURY



. . . it's stocked with the equipment you need for your immediate and long range drilling and production needs. The convenience of the SUPPLY STORE, the specialized knowledge of its personnel, and their conscientious service combine to save you many hours and many dollars on your well.

Among the wide variety of equipment available, you will find quality Baash-Ross slips, rotary bushings, safety clamps, spiders and other Baash-Ross drilling and production equipment. For convenience in buying —*there's no need to go off in all directions.* Just head for your SUPPLY STORE.

BAASH-ROSS DIVISION

OF JOY MANUFACTURING COMPANY

GENERAL OFFICES: 5306 CLINTON DRIVE, HOUSTON, TEXAS

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FOREIGN OFFICES:

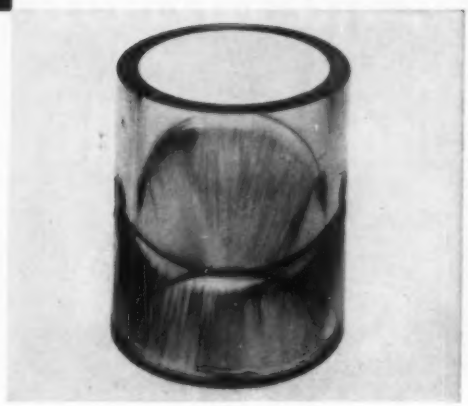
Monte Carlo, Monaco; Mexico City, Mexico; Greenock, Scotland; London, England; Paris, France; Caracas, Venezuela; Buenos Aires, Argentina; Rio de Janeiro, Brazil; Tokyo, Japan

BAASH-ROSS JOY

UNICOR®-LHS

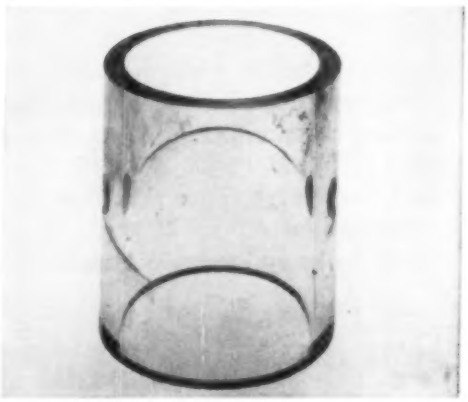
Highest Detergent Activity in an Anti-Icing Agent

The three photos on the right were taken of glass throttle bodies at the conclusion of a carburetor cleanliness test in which the additives, at low anti-icing dosages, were compared on an equal cost basis.



No additive

Best competitive detergent additive



Unicor-LHS

Sure-fire prevention of carburetor icing—*plus* positive prevention of carburetor clogging! That's what you give your customers when you safeguard your gasoline by adding Unicor-LHS.

In addition to its well-known anti-icing and corrosion-protective characteristics, Unicor-LHS provides ideal detergency action. Recent tests at Universal's laboratories (see photos at right) demonstrate that Unicor-LHS imparts greater detergency to your fuel than the best competing additives.

Convenient and economical to use, this anti-icing additive can be introduced anywhere—refinery, bulk plant or filling station—at less than half the cost of ordinary anti-icers.

We shall be glad to determine the exact anti-icing and carburetor detergency requirements of your fuels.

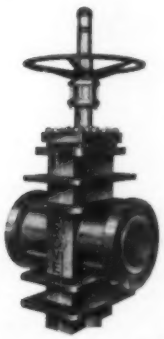
For detailed information, samples, or commercial quantities, write to our Products Department.

UNIVERSAL OIL PRODUCTS COMPANY
30 Algonquin Road, Des Plaines, Illinois, U.S.A.

More Than Forty Years Of Leadership In Petroleum Refining Technology

IN CASE OF ANY EMERGENCY

HERE'S THE VALVE YOU KNOW WILL WORK



This is a rugged, dependable valve you can forget until you really need it. When you do—it'll work. There's no wedging to cause wear and jamming. The polished gate slides easily and quickly between smooth metal seats and rugged "O" rings. Exclusive Grove design lets gate and seats float free—eliminates distorting effects of pipe-line strain, internal pressure and temperature. Requires as many as 250 less turns to close than some competitive valves, too.

And, there's no lubricant to forget or to be washed away. Tough, flexible "O" rings are always there when you need them to give a bubble tight seal every time.

The next time you need valves, call your Grove man. He has the valves you can really depend on.

GROVE VALVE and REGULATOR COMPANY

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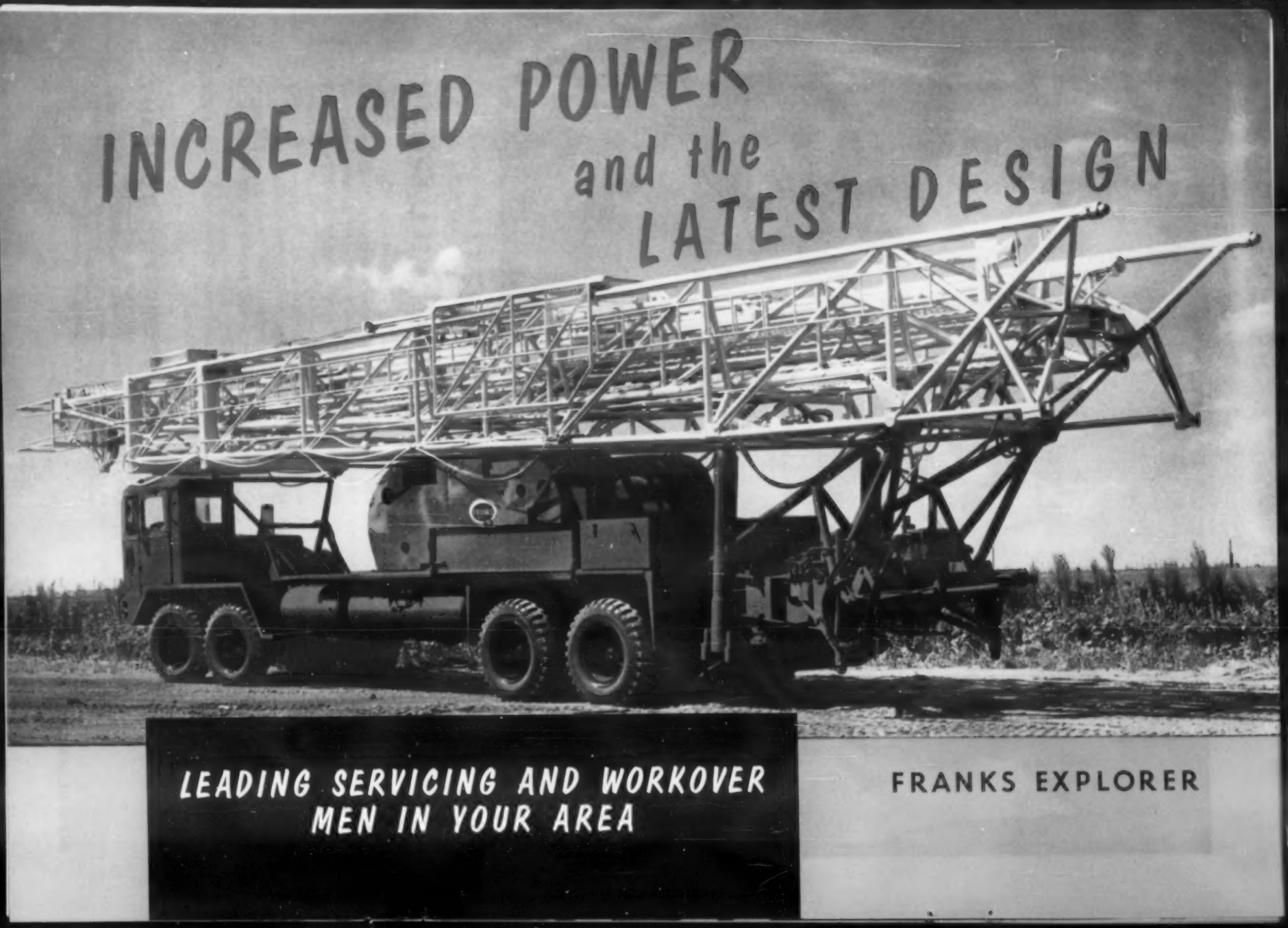

INCREASED POWER
and the
LATEST DESIGN
LEADING SERVICING AND WORKOVER
MEN IN YOUR AREA
FRANKS EXPLORER

. . . WILL TELL YOU THAT TO MEET THE INCREASING DEMANDS OF SERVICING AND WORKOVER TODAY IT TAKES EQUIPMENT LIKE THE FRANKS EXPLORER TO DO THE JOB.

THEY'RE OUTSELLING OLDER DESIGN UNITS.

TO GIVE BETTER SERVICE USE FRANKS

TO GET BETTER SERVICE USE FRANKS

EASY UP!
EASY DOWN!

EXPLORER FEATURES

NEW HARDENED, REMOVABLE FLOATING BRAKE RIMS.
NEW CONTROLS for easier, faster, safer handling.
ALL MODELS AVAILABLE WITH TORQUE CONVERTERS.

INDUSTRIAL ENGINE — Waukesha, Cummins, G.M. or equivalent up to 400 H.P.
NEW MAIN DRUM DESIGN for fastest, safest pulling.
NEW WATER AND AIR COOLING BRAKE SYSTEM. (Pat. applied for.)

WELL SERVICING AND DRILLING UNITS

FRANKS

DIVISION OF CABOT SHOPS, INC.

PAMPA, TEXAS

SEE OUR EXHIBIT AT INTERNATIONAL PETROLEUM EXPOSITION—MAY 14-23, TULSA, OKLAHOMA

BUNKERING...

by ESSO at Newport News through 12 BRODIE BiRotor METERS

Ore Unloading Dock, where battery of 3 *BiRotor* Meters measure bunker fuel to various dock locations.

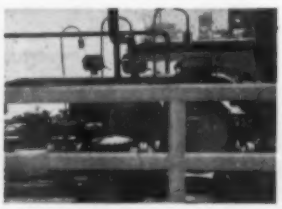
EVERYWHERE, BRODIE is linked with progress. Here's another example from VIRGINIA

At the C&O Coal and Ore Handling Docks in this busy Virginia port, ESSO Standard Oil Company takes advantage of the sustained accuracy of Brodie *BiRotors*. The meters record and control loading and blending into tanks of ships and barges. The first *BiRotor* installation was over 11 years ago. Along with later models which have been added from time to time, original Brodie Meters are in constant use after millions of gallons measured.

If you plan a metering installation of any size, where accuracy and low maintenance are important, why not discuss your problem with the Brodie Metering Specialist – as near as your phone?

817

Brodimatic Printing Counters provide verified delivery receipts. Note easy readability of large figures.



At the Coal Loading Dock, another group of Brodie Meters and Strainers. Counters may face any of 12 directions.

Master meter used to calibrate various dock meters is proved by weigh tank at right. Installation was recently enclosed.

Blending installation, one of three, where Bunker C and Marine Diesel are blended directly to ships and barges.

BRODIE BiRotor METERS

RALPH N. BRODIE COMPANY • San Leandro, California, U. S. A.
CABLE ADDRESS: "BRODICO"

MT. VERNON, N.Y. 550 So. Columbus Ave.
DALLAS 7, TEXAS 167 Parkhouse St.
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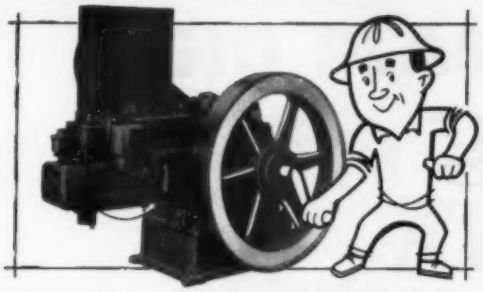
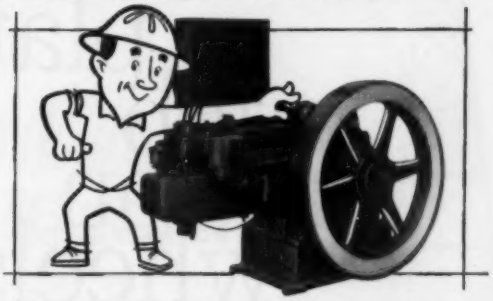
REPRESENTATIVES WITH STOCKS AND SERVICE FACILITIES IN ALL PRINCIPAL CITIES

EASY TO START

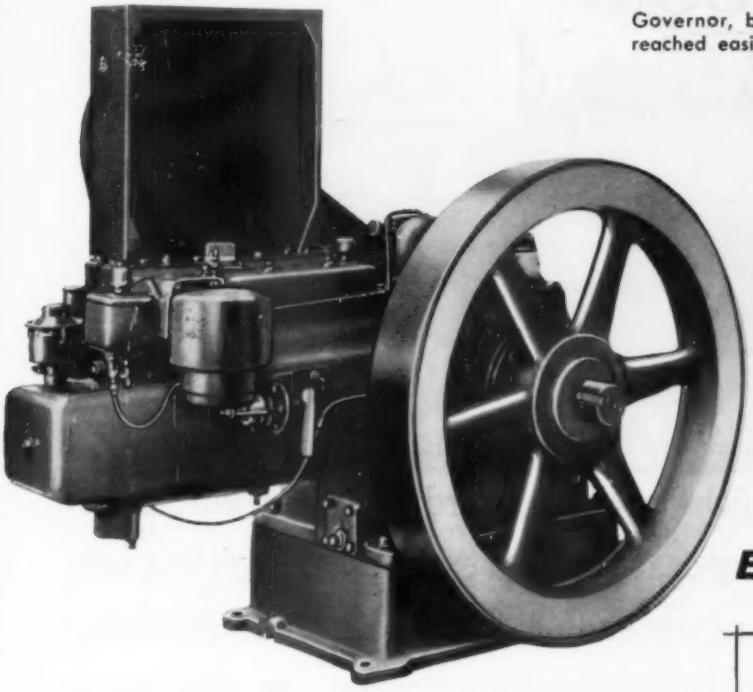


Hot, cold or wet weather conditions do not prevent C-E Engines from starting easily.

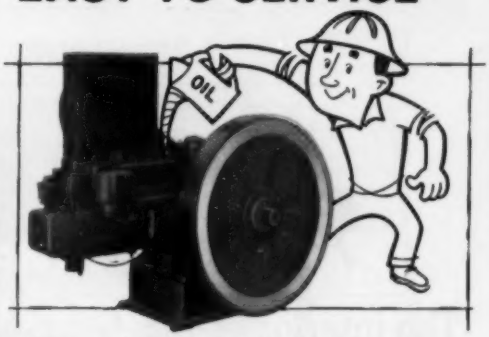
EASY TO ADJUST



Governor, bearings, carburetor, etc. can be reached easily for quick, accurate adjustment.

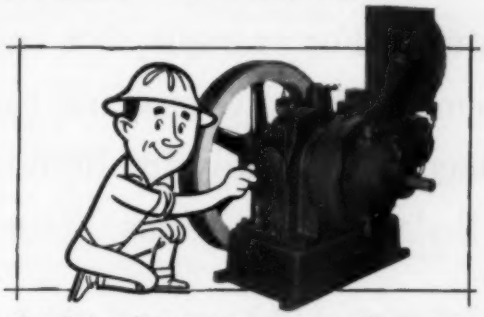


EASY TO SERVICE



Water or oil can be added . . their levels checked . . while the engine is running.

EASY TO REPAIR



Essential working parts or unit assemblies . . can be replaced in the field without disturbing other assemblies.

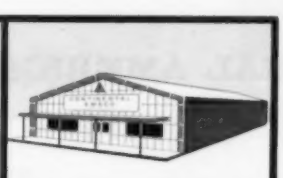
C-E Engines Cut Pumping Costs

It takes less time to service and maintain these engines, so more engines can be checked by fewer field men. Take advantage of this lower cost maintenance . . buy your next pumping engines from Continental-Emsco . . and reduce your production costs.

For Service that Sings . . Equipment that Hums . . Go . .

CONTINENTAL-EMSCO

Serving the Oil and Gas Industries ... Worldwide



CE702

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CYCOLAC®

THE TOUGH, HARD **ABS** PLASTIC
from BORG-WARNER

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Write for the name of your nearest supplier

10 Reasons why you're right with Rigid Pipe made of CYCOLAC!

1. **LIGHTWEIGHT.** Easy to carry — approximately ⅛ the weight of comparable iron.
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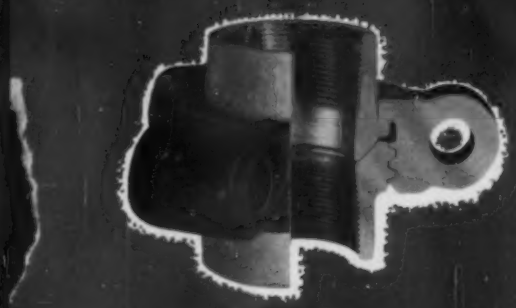
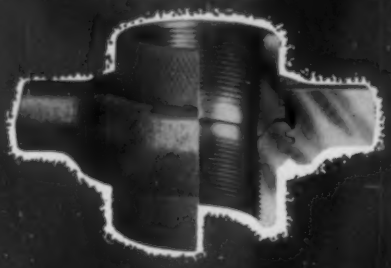


Fig. 100 Union
Sizes: 2, 2½, 3, 4, 6, 8
1000 p.s.i Test

Fig. 200 Union
Sizes: 1, 1¼, 1½, 2, 2½, 3, 4, 6, 8, 10
2000 p.s.i. Test



WECO

Fig. 400 Union
Sizes: 6, 7, 8, 10*, 12*
4000 p.s.i. Test
*2500 p.s.i. Test

Fig
Sizes: 1,
600

ALL

Fig. 1502 Union
Sizes: 2, 2½, 3
15,000 p.s.i. Test

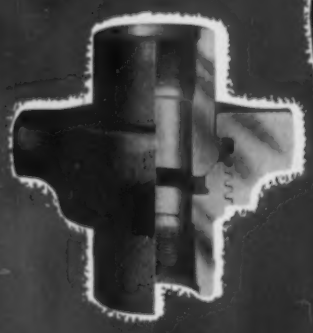


Fig. 1003 Mis-Aligning Union
Sizes: 2, 2½, 3, 4
10,000 p.s.i. Test

Fig. 211 Insulated Union
Sizes: 1, 1½, 2, 2½, 3, 4
2000 p.s.i. Test

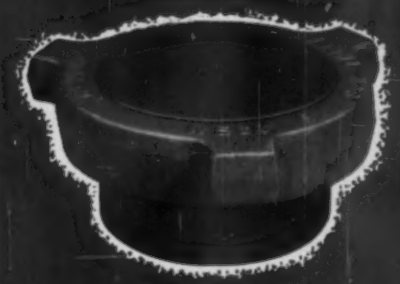
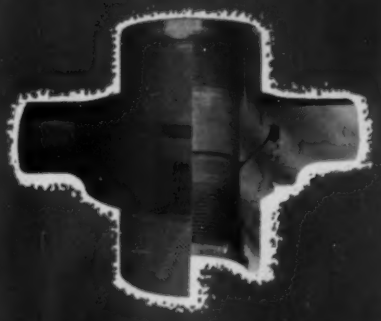


Fig. 208 Union
Sizes: 3, 4, 6, 8, 10
2000 p.s.i. Test

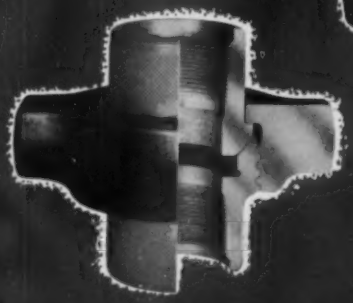
Fig. 400 Union
Sizes: 2, 2½, 3, 4, 5½
4000 p.s.i. Test



ALL SIZES

Fig. 600 Union
1, 1½, 2, 2½, 3, 4
6000 p.s.i. Test

Fig. 602 Union
Sizes: 1, 1¼, 1½, 2,
2½, 3, 4
6000 p.s.i. Test



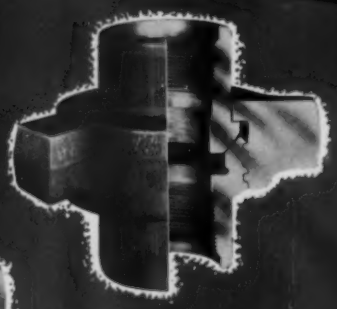


Fig. 1002 Union
Sizes: 1, 1½, 2, 3, 4
10,000 p.s.i. Test

L PRESSURES

Flat Face Union
Sizes: 2, 3, 4
Fig. 415, 4000 p.s.i. Test
Fig. 615, 6000 p.s.i. Test

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HOUSTON, TEXAS

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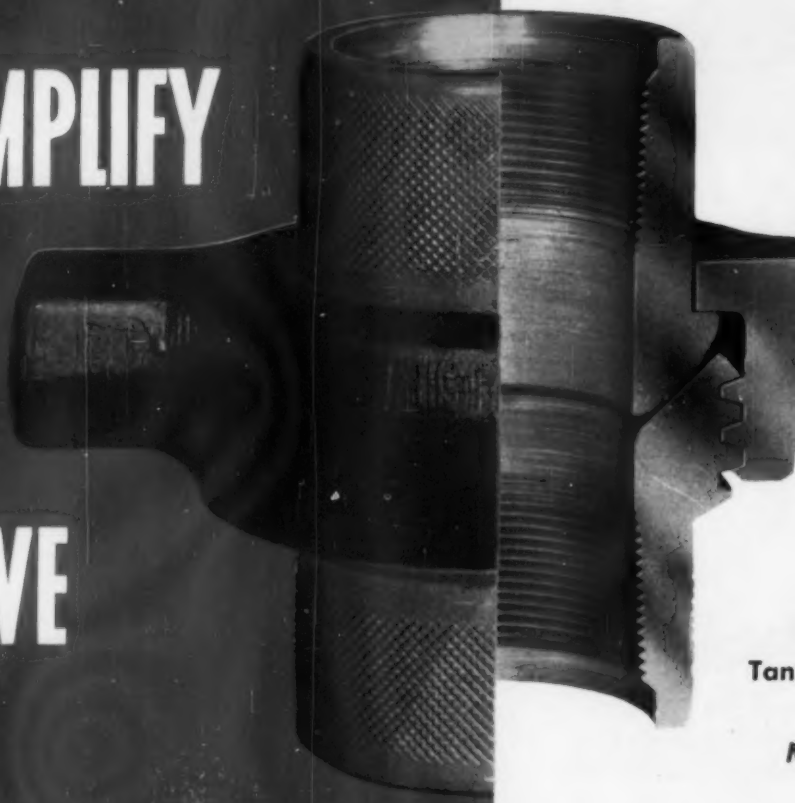

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Steam Lines . . .

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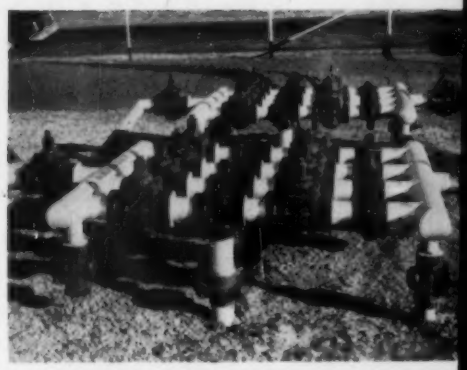

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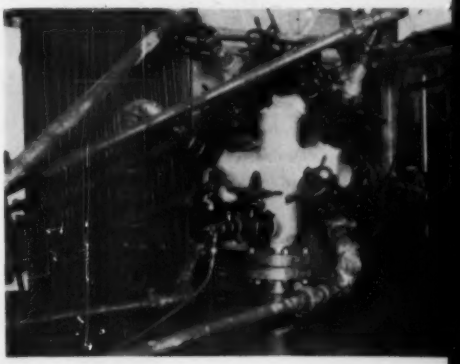

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of*
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U—1—59

THE MIGHTY-MITE IN WATER ABSORPTION

ANOTHER
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ACHIEVEMENT

NEW SPHERICAL GLYCOL UNIT

Patents Pending

With a basketball-size* spherical absorber, Parkersburg's new Mighty-Mite represents one of the most **outstanding engineering achievements** in glycol dehydration history.

Field tests prove that a dew-point depression of 65° F. can be guaranteed, with dew-point depression as high as 100° F. not uncommon.

The Mighty-Mite is a skid-mounted, compact unit no larger than the top of an ordinary office desk.

MIGHTY-MITE Features:

- Reduced purchase, operation and maintenance cost.
- Simple, trouble-free operation.
- Ideal for off-shore operations because of its light weight, space-saving size.

*** for 3 mm cu. ft./DAY CAPACITY.**

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Here are a few of its many features that insure greater strength and safety, longer service life and lower maintenance cost: Forged Steel body, bonnet and gland..."375 Brinell" stem with rolled stem threads..."500 Brinell" disc-lapped seat face...molded, reinforced asbestos packing. Test Pressures: Hydrostatic Shell test, 2500 P.S.I....Seat Test (air under water), 100 P.S.I....Pneumatic Testing at 300 P.S.I. when specified. For details, *write for Folder DH-213.*

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ACCO

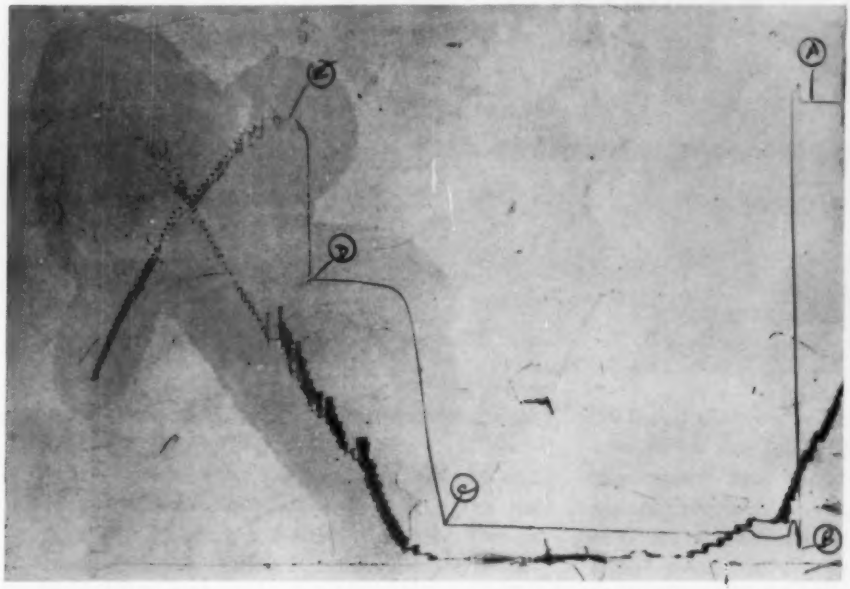
168 Barrels Of Oil A Day From A Dry Hole

This is the story of how an apparent dry hole was made a 168 bopd producer. The well was drilled by Mr. A. C. Torgeson of Torgeson Oils, Inc. who realized a successful producer from a wildcat well that could easily have been abandoned. The well was spudded in Weld County, Colorado, and was projected for the "J" sand around 6900 ft. The sand, when reached, was cored and an electric log was run. These revealed conclusively that the "J" sand was unproductive . . . that it contained only water. Had it not been for the alertness of the consulting geologist on the well, Paul "Skipper" Keller, the well would have been plugged and abandoned. Keller, however, had noticed an oil show in the cuttings from the "D" sand approximately 100 feet up the hole. The "D" sand was generally unproductive in the area and a thorough study of all available evidence indicated that it probably would be unproductive in this well even though there was a show in the cuttings. Normally a well of this type would have been abandoned immediately, but Mr. Keller was reluctant to do this in spite of the seemingly overwhelming odds against making a successful producer. The decision was then made to run a drill stem test in order to evaluate all the available information. The result was a producer!!!

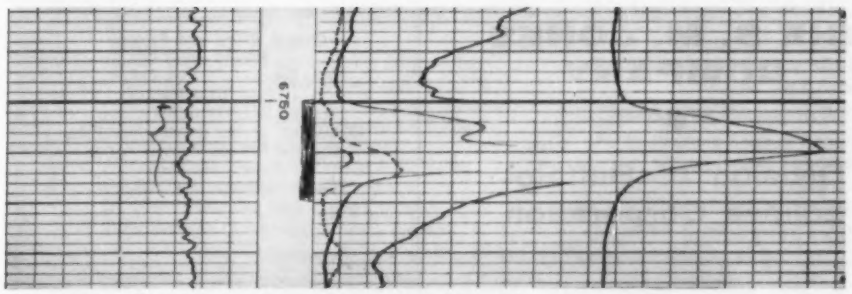
To obtain the test information which resulted in a positive decision to complete the well, Johnston Testers was called in from the Fort Morgan office and a straddle test was run. On the basis of the drill stem test, casing was set and the well perforated from 6758 to 6764 ft. The initial flow of the well was 168 bopd through a 30/64" choke. No well stimulation treatment was required and a dry hole became a producer.

This is an excellent example of the necessity of gathering and evaluating all the data possible before setting casing on a well that might be dry, or before abandoning a possible producer.

This well clearly demonstrates that it is unwise to discount any possible pay or write-off any well prematurely. It also demonstrates that Drill Stem Testing pays off in handsome dividends. The cost of a drill stem test is very small compared to the investment made in the drilling of the well. Test—to be absolutely sure.



Drill Stem Test chart for the Torgeson State No. 1. Tool was open for two hours with forty-five min. shut-in. Gas to surface in 18 min. (800,000 cu. ft.) and a good blow was observed. 550 ft. of oil and 270 ft. of oil and gas cut mud were recovered. No water was present. Initial flow (B) was 108 psi and final flow (C) was 291 psi. Final shut-in pressure (D) was 2221 psi.



Log showing SP and Resistivity curves at perforated interval.

JOHNSTON
DRILL STEM TESTING
TESTERS

There is a difference in sucker rods.

For over 65 years, the S. M. Jones Company has applied **advanced** *field research, engineering, and metallurgy to the manufacture of sucker rods.*

RESULTS: **Jones Sucker Rods** that are the standard of comparison because of their *proved* **longer life.**

"The S. M. Jones Company modern manufacturing plant, Toledo, Ohio"

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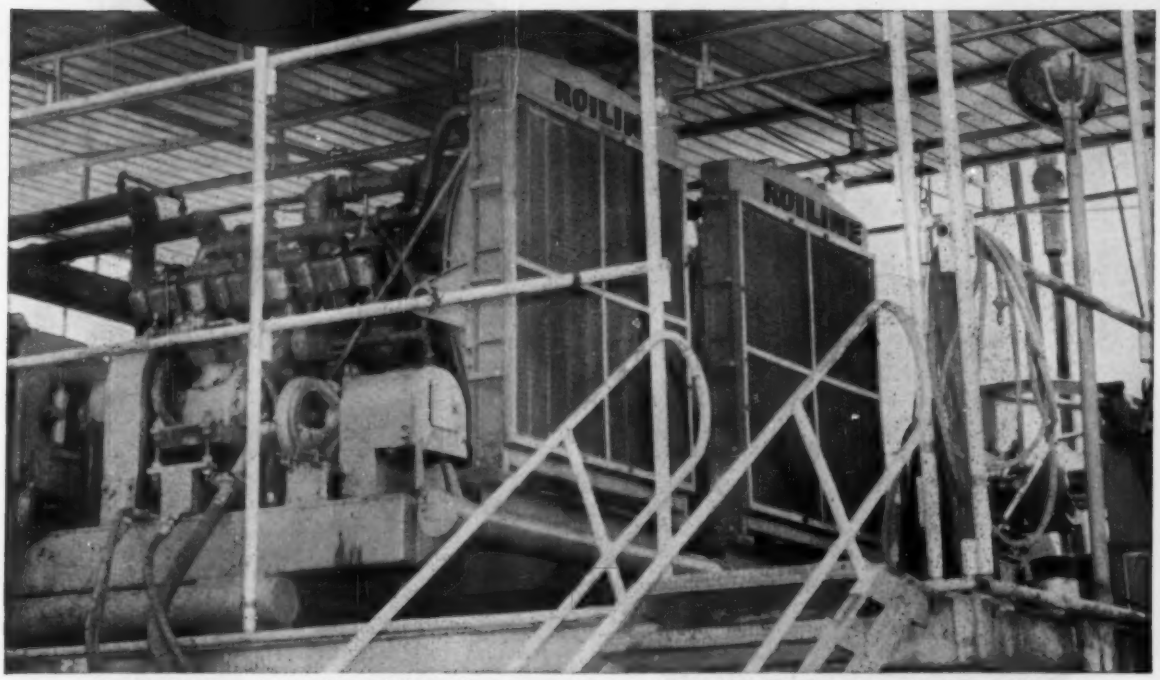
for more power per fuel dollar



Langford Drilling Co. Rig No. 2 drilling well at Sherman, Texas, for Lone Star Gas Co.—powered by two L-3000 Roiline gas engines—3006 cu. in. displ., V-12 cylinders, 6¾-in. bore x 7-in. stroke—each 402 max. hp at 1100 rpm.

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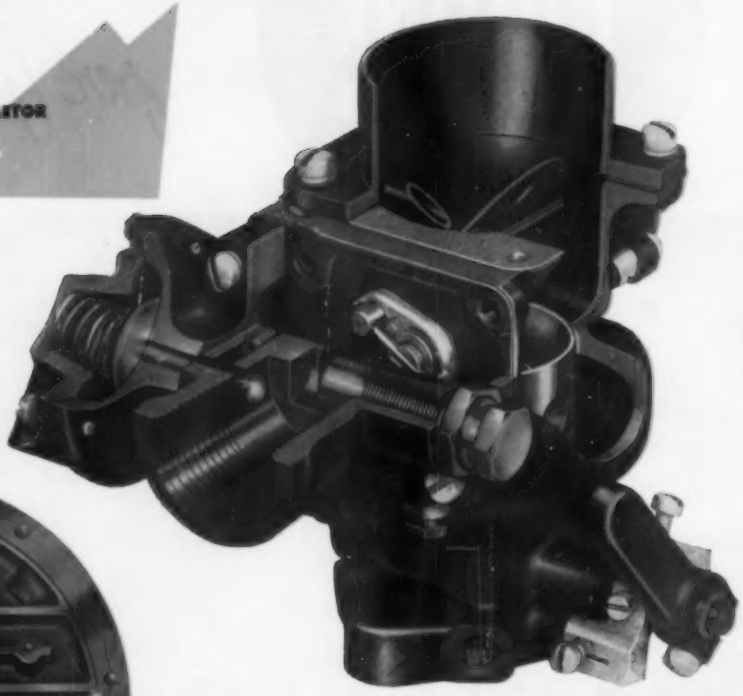

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*OEM *means* "Original Equipment Manufacturer." *It is his responsibility to select engine components, carburetors, etc., that will safeguard the reputation of his engines and to assure his own customers the utmost in dependability, economy and performance. Ensign has been Original Equipment on many of America's leading gas engines for years.*

For complete details of all Ensign LP-GAS equipment, send for Catalog 108.

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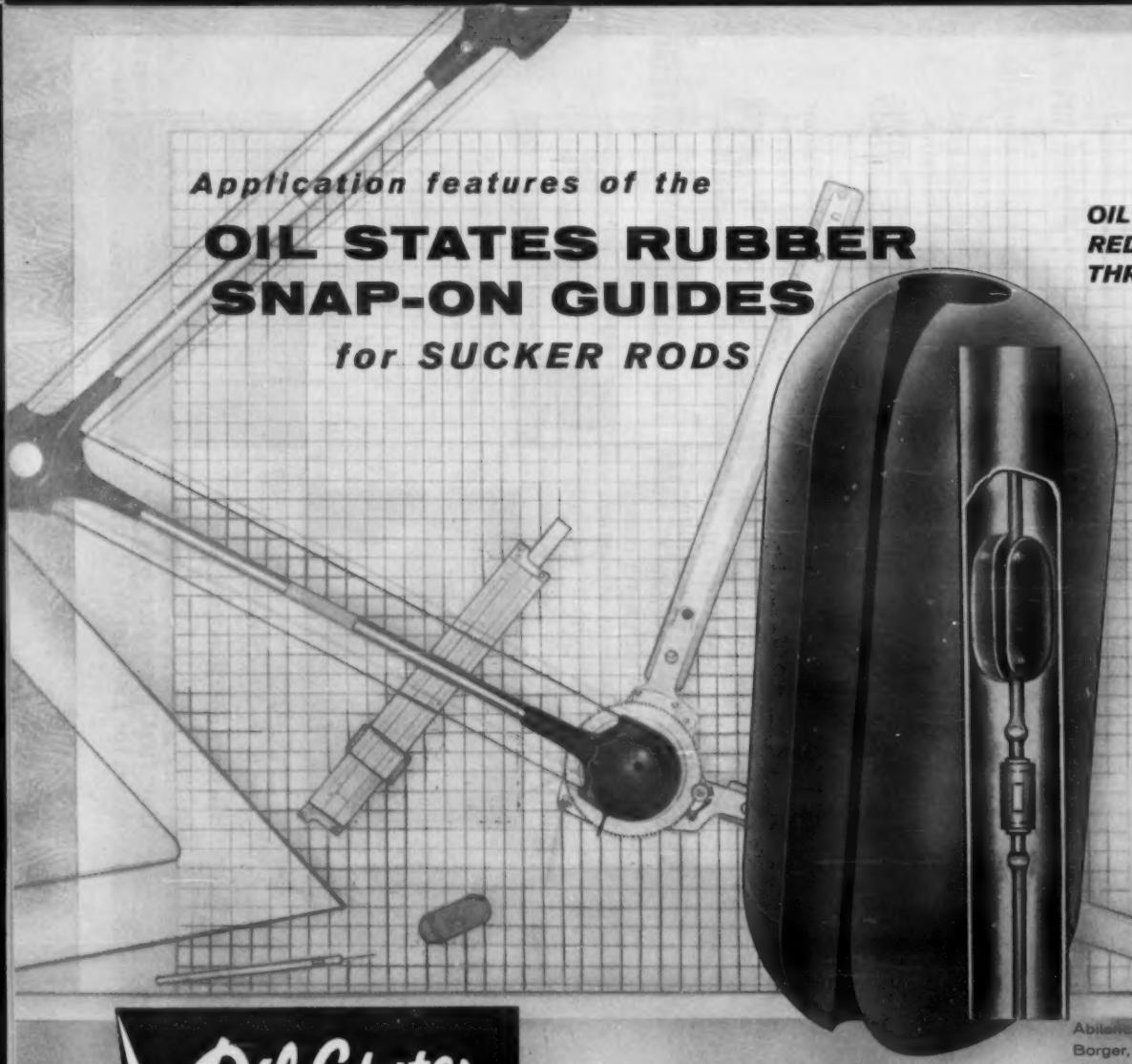
When you put OEM quality into your LP-Gas installations, you use equipment as pictured here, the finest that money can produce. It is the same Ensign equipment used by Original Equipment Manufacturers for their tractors, trucks, power units, etc.

Examine these parts carefully. They are built of ruggedly designed bronze alloy castings, carefully machined to highest automotive standards. OEM engineers have learned through many years that they can count on Ensign equipment not only for top performance during a laboratory or field test, but during the lifetime of their engines. You, too, may enjoy this excellent LP-Gas performance consistently year in and year out by specifying Ensign carburetion. *Insist on Ensign. Accept nothing less!*

Application features of the

OIL STATES RUBBER SNAP-ON GUIDES

for SUCKER RODS



OIL STATES RUBBER SNAP-ON GUIDES REDUCE OPERATING COSTS THROUGH THESE APPLICATIONS--

- Used in crooked holes or directionally drilled wells, to minimize wear on rods and tubing.
- Prevention of metal-to-metal contact in *any* well, giving low-friction bearing surfaces, with less power needed to lift the same amount of fluid.
- Lessens wear on the pump, by installing several SNAP-ON GUIDES just above the pump to deaden rod whip.
- Installed closely spaced in paraffin deposit zones, so that the SNAP-ON GUIDES will overlap on the stroke length, preventing paraffin deposit build-up.
- To prevent wear on rods in wells with low polish rod loads on the downstroke, as when "plunger" pumps are used, by eliminating rod bending inside the tubing.

Sold Through Supply Stores Only

THE OIL STATES RUBBER SNAP-ON SUCKER ROD GUIDE
Patent No. 2,604,364

Contact your local OIL STATES Field Representative for analysis and recommendations for your particular well requirements. It costs you nothing for this professional analysis and it may save you thousands of dollars in rod replacements and service costs.

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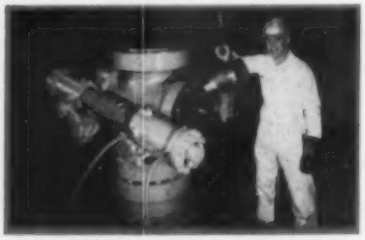
He simply didn't hit it. At Spindletop they let 'em gush — it spelled success. But in the early 1920's penetration of high pressure gas zones was not just a problem, it was a real peril. Available equipment could not control the ever increasing pressure.

Jim Abercrombie of Houston was one of the operators who had experienced the blazing destruction of uncontrolled gas pressure. He decided to do something about it, and shortly the first successful blowout preventer was making news wherever pressure had been a problem. For the first time rigs, reserves and roughnecks were safe from the danger that had been considered an act of God. Operators were free to probe deeper for more pay.

These first preventers were made in Mr. Abercrombie's newly acquired Cameron Iron Works, the year was 1922. Intervening years at Cameron have seen continuous research and design development of pressure controls for drilling and production. Staying ahead of a problem which never ceases has made Cameron equipment important throughout the oil producing areas of the world —

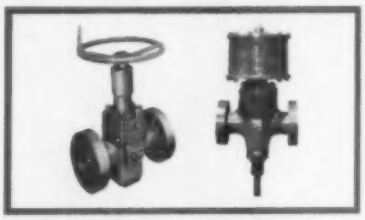


Type "F" Blowout Preventer with pressure balanced design is positive protection for any drilling operation.

wherever operators must protect personnel and profits.

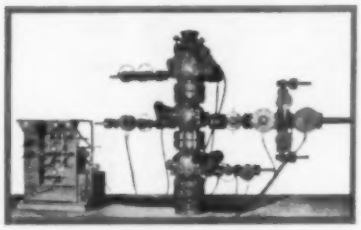
Our first preventer was designed for 1500 psi W. P. with 3000 psi test; our latest will control ten times as much pressure — 15,000 psi and is tested to 22,500 psi. Many related developments have resulted from our research.

The most outstanding of these is a new manufacturing process — the Cameron split-die forging method. The original shop handled machine work almost exclusively. Today we make our own steel, forge, heat-treat, machine, assemble, and test. Our activities include production of components for atomic reactors, jet engines, guided missiles, and, of course, Cameron pressure controls for drilling and production.



Cameron Gate Valves offer the longest maintenance free operation of any valve on the market today.

World-wide sales representation is conveniently located to serve every major oil producing area of the free world. You can COUNT ON CAMERON for safety and profits when pressure is a problem.



Cameron Control Panel employs a diagram of the entire preventer hookup for safe, easy operation.

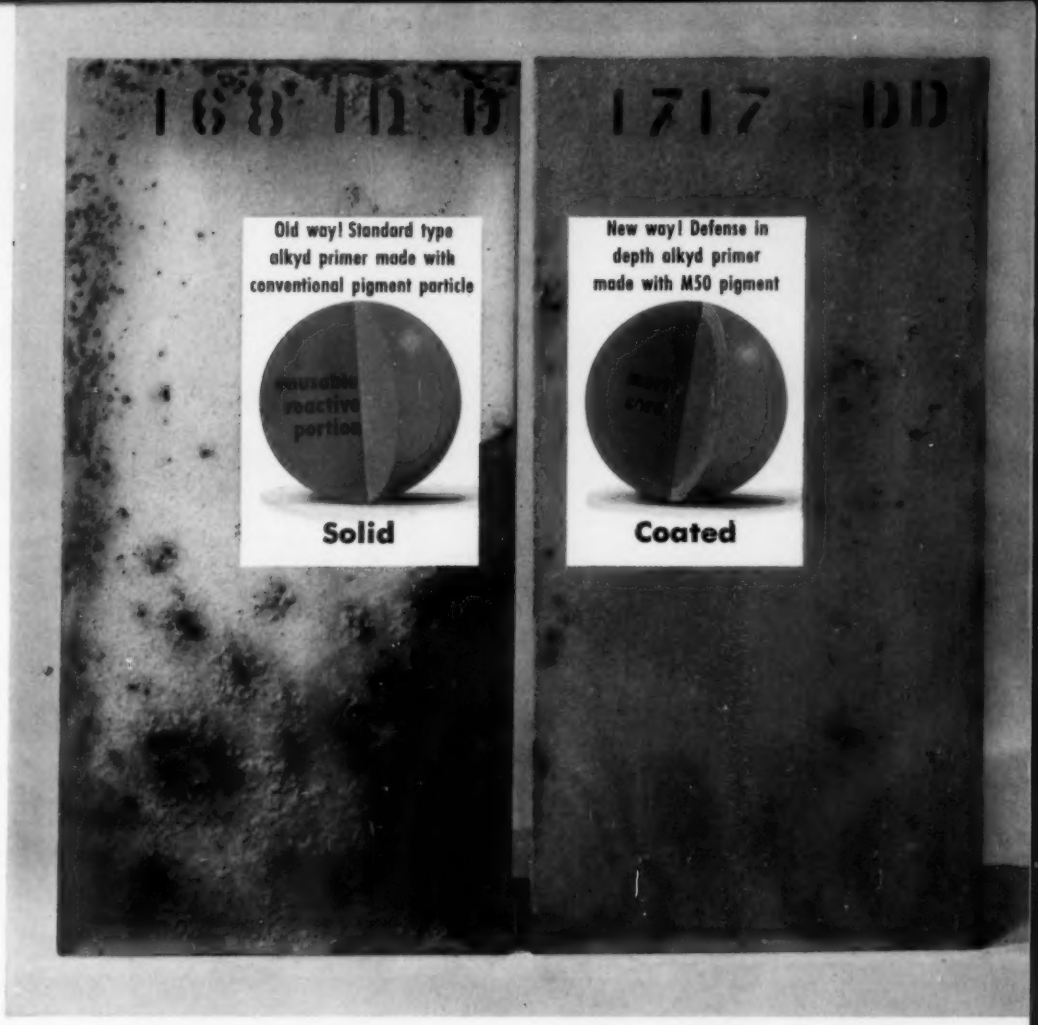
Cameron

IRON WORKS, INC.

P. O. Box 1212 — Houston, Texas

Export Office: 7912 Empire State Bldg., New York City. In England: Cameron Iron Works Ltd., 76 Grosvenor St., London W. 1 England

Never before such durable tank protection


Old way! Standard type alkyd primer made with conventional pigment particle
Solid
New way! Defense in depth alkyd primer made with M50 pigment
Coated

Proof tank paints with M50® pigment form rust-inhibitive films of outstanding strength and durability

Test panels like these *prove* what paints can do. And these two make it plain that paints containing *M50* basic lead silico chromate — a new National Lead rust-inhibitive pigment ... form outstandingly strong and durable protective films.

Excepting the pigment, both primers shown on the test panels contain the same ingredients. Both are applied (2.0 mils, dry) on rusted and mill-scaled steel (to increase test's severity). Both have been exposed 12 months in industrial atmosphere (Perth Amboy, N. J.) and 12 months in normal atmosphere (Sayville, L. I.) at 45° South. You can see the effect.

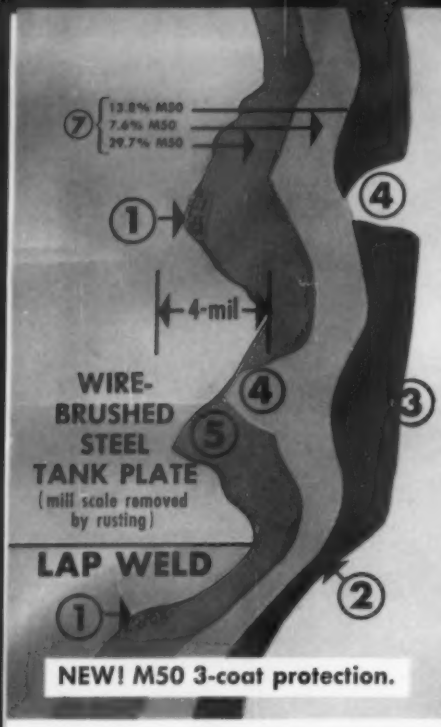
A striking difference! Yet film strengthening proves to be only one of many improvements that *M50* pigment makes in metal protective paints for steel tanks and structures. Now — with new *M50* pigment — your regular paint suppliers can provide metal protective paints with outstanding advantages:

- Weather-resistant anti-corrosive primers.
- Intermediate and finish paints *with* exceptional rust inhibition but *without* bilging hazard in sulfur-laden atmospheres.
- Finish paints in a wide range of decorative colors that don't fade or wash out.
- Alkyd-type conventional and heavy-coat paints with outstanding durability, package stability and sprayability.

What makes the difference? Basically the differences that make a difference in *M50* pigmented paints are inherent in the unique *M50* coated pigment particle itself (idealized particle shown above.) See, on the next page, the extra protections the *M50* particle provides in the dried film. See, too, how you can get the benefits of these new, much more durable, anti-corrosive paints.

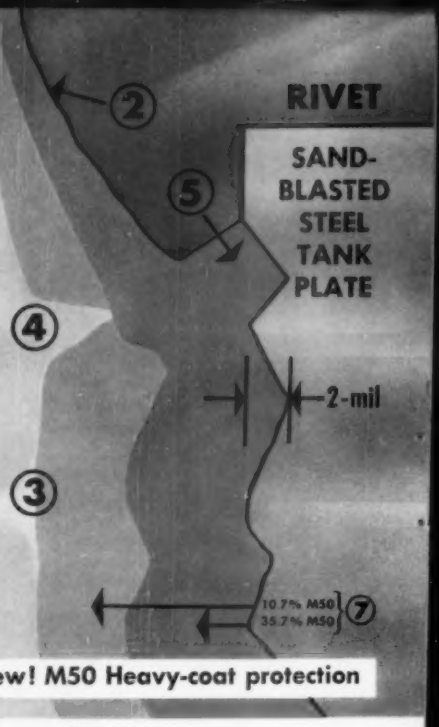
M50 pigment is a product of National Lead Company

General Offices: 111 Broadway • New York 6, N. Y.



NEW! M50 3-coat protection.

1. **Pockets of rust prove less harmful** on steel surfaces painted with conventional *M50* paints. Vehicles penetrate and isolate existing rust. *M50* particles stop rusting action.
2. **Where paint film lies thin** over tiny surface projections and sharp structural edges, the *rust-inhibitive* pigment content in all coats of *M50* paints provides extra protection.
3. **Just-right flow characteristics of package-stable** *M50* paints aid leveling on rough steel surfaces, promote smoothness, good appearance.
4. **Inevitable "holidays" in film** do not destroy protection. Again, *all M50* coats have both rust inhibition *and* weather resistance.
5. ***M50* paints "wet" well,** penetrate pits and crevices, carry *M50* protection to every part of these danger spots.
6. **Lightweight *M50* particle** aids formulation of new type heavy-coat paints with *uniform* rust inhibition throughout the film and low sag characteristics.
7. **Every coat can have rust inhibition** — not just the primer. Note percentages of *M50* in dry films. What's more, for equal weights of corrosion-inhibitive pigment, *M50* primers contain 40-60% more corrosion inhibition by volume than non-*M50* primers.



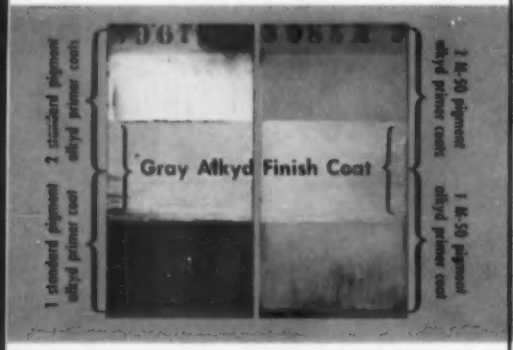
New! M50 Heavy-coat protection

Sections through M50 Defense in Depth films show dramatic extra protection these new tank paints provide

Information on the preceding page proves that *M50* pigment paints form stronger protective films than anti-corrosive paints made with other rust-inhibiting pigments. The sections above show some of the ways in which these new paints perform better in the dry film. Below you will see *proof* that *M50* metal protective paints don't bilge, are unique for color stability and the color range in which they can be made.

Hold the *M50* pigment particle itself responsible for all these improvements . . . *Basic lead chromate* is known for exceptional rust-inhibiting action. In the *M50* particle, this reactive business portion of the particle is coated on an inert core . . . where *all of it is available* to react. The coating is *fused* on—shows superior resistance to chalking, erosion, chemical action. Unusual tintability is due to the geometric configuration of the coated silica particle.

Why M50 Defense in Depth paints give anti-corrosion beyond all former concepts

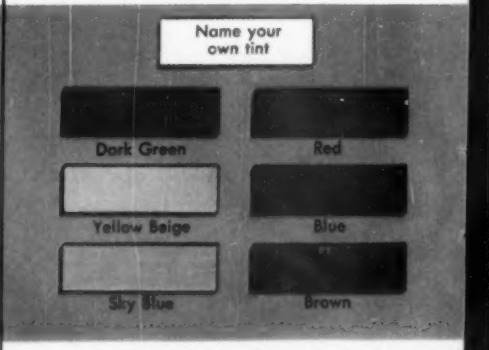

1 standard pigment alkyd primer coat
2 standard pigment alkyd primer coats
Gray Alkyd Finish Coat
2 M-50 pigment alkyd primer coats
1 M-50 pigment alkyd primer coat

Exposed 9 years, 45°S. Each coat 1.5 mils

Proved corrosion and weather resistance

Exposed 4 years adjacent to refinery

Proved anti-bilging performance



Available in conventional and heavy-coat paints

Proved stability in wide range of colors

Are you concerned with tank or structure maintenance painting in your firm? If so, you are invited: (1) to visit National Lead's Sayville, L.I. test station, where you will see the results of the 20 years research that lies behind the *M50* pigment particle and the more than 10 years of exposure testing that lies behind *M50* pigment Defense in Depth paints; (2) to send coupon below for National Lead booklet, "Defense in Depth" and typical *M50* tank paint specifications.

Next time you purchase, specify *M50* pigment paints. Any paint manufacturer can supply you.

M50 Defense in Depth

National Lead Company,
111 Broadway, New York 6, N. Y.

Gentlemen: Please send me the "Defense in Depth" booklet together with typical tank paint formulas and color chips that I can use in specifying M50-type tank paints.

Name_____ Title_____

Firm or Dept._____

Address_____

City_____ State_____

They Say—

Depletion Study Makes a Big Hit

Dear Sir:

I have read with much interest and complete satisfaction the article concerning Percentage Depletion ("The Case for 27½% Depletion," OGJ, Feb. 23, p. 99). It is certainly the best presentation I have read.

I like it particularly because you emphasize the fact that depletion represents only the percentage of oil in the ground that is capital and is not profit.

My only criticism is that you say oil, gas, coal, and other minerals are considered to be capital in their original state in the ground. I would not have used the word "considered."

I was greatly pleased with the portion of the article dealing with depletion as it affects conservation. That is a matter that I think has been neglected in our argument . . .

Warwick M. Downing
Chairman
Colorado Oil and Gas Conservation Commission
Denver.

Dear Sir:

. . . I believe this is the clearest and most convincing treatise on this subject that I have seen. It should be a most valuable contribution toward the defense of the present attacks in Congress.

Paul Endacott
President
Phillips Petroleum Co.

Dear Sir:

. . . It should be required reading for everyone in the oil and gas industry . . .

Ernest O. Thompson
Chairman
Texas Railroad Commission
Austin.

Dear Sir:

. . . I am sure the material will be of great help to us in talking to our friends about this extremely important matter.

H. C. Teasdel
President
The California Co.

Dear Sir:

. . . The illustrations are particularly appropriate and certainly hammer home the points covered in the article . . . You have told a vital message in a most interesting manner . . .

O. H. Hoversten
Gulf Oil Corp.
Pittsburgh.

Dear Sir:

. . . It should be extremely helpful in providing factual data which can be used to get the story across to the general public . . .

Kerryn King
Vice President
The Texas Co.
New York.

Dear Sir:

. . . The Oil and Gas Journal has performed an outstanding service in preparing this report . . .

James O. Kemm
Executive Manager
Oklahoma Petroleum Council.

Dear Sir:

. . . I found it clear and readable. In fact, it's the best story on depletion I've ever seen.

J. J. Arps
Vice President
British-American Oil Producing Co.

Wrong number was right

Dear Sir:

We noticed a mistake in The Oil and Gas Journal, Vol. 57, of February 9, 1959.

In our mind it should be read No. 6 instead of 7.

Laboratoires de Recherches
Purfina, S. A.
Brussels, Belgium

(Editor's note: Petroleum Panorama, the special historical issue of the Journal, was published as Vol. 57, No. 5. As a result, numbers of the regular weekly issues skipped from 4 to 6.)

Labor faces the issue

Dear Sir:

Permission is requested to reprint "Refinery Maintenance Gets New Look" on page 79 of the March 9 issue of The Oil and Gas Journal.

While it is true that "labor unions generally fear the movement," it is

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for cost analysis and estimating of nuclear power reactors and related equipment. Heavy estimating experience in any of the following fields desirable: construction (electrical and instrumentation); shop and power plant or refinery. Should have familiarity with estimating tanks and pressure vessels. Experience in interpreting cost feedback and development of cost parameters helpful.

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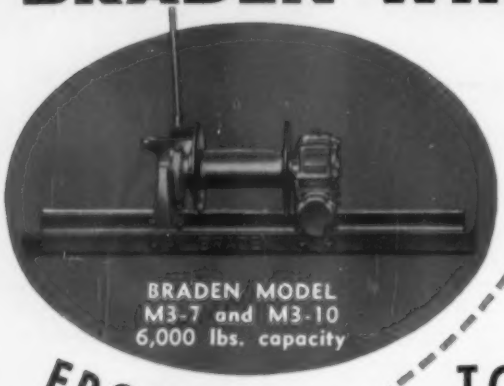
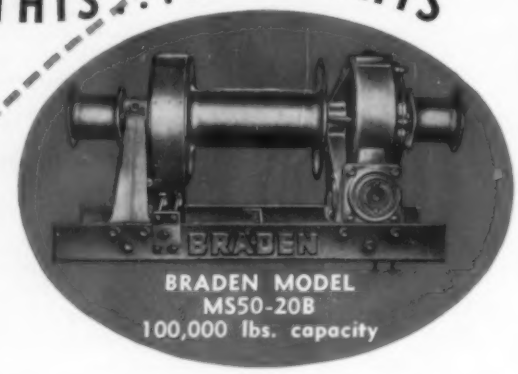


FROM THIS....TO THIS



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E. H. Hartwig
Editor, Central States Petroleum News,
Official Publication of Central States Petroleum Union
Wood River, Ill.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

MARCH

23-24 University of Oklahoma, second conference on theory of fluid flow through porous media, Norman, Okla.

25-27 American Petroleum Institute, Division of Production, southern district meeting, Roosevelt Hotel, New Orleans.

26-27 Southern California Meter Association, eighth annual instrument short course, Los Angeles Harbor Junior College, Wilmington, Calif.

31 Seventh annual meeting, Philadelphia-Wilmington section of American Institute of Chemical Engineers, and University of Pennsylvania, Philadelphia.

29-Apr. 2 American Society of Mechanical Engineers, instruments and regulators division conference, Case Institute of Technology, Cleveland.

APRIL

2-3 Society of Petroleum Engineers of AIME, Rocky Mountain petroleum section, Casper, Wyo.

2-3 American Institute of Mining, Metallurgical, and Petroleum Engineers, technical conference on stress corrosion, Mellon Institute, Pittsburgh.

2-4 Society of Economic Paleontologists and Mineralogists, Permian basin section, annual meeting, Roswell, N. M.

2-6 Geological Society of America, Cordilleran section, annual meeting, University of Arizona campus, Tucson.

5-10 Engineers Joint Council, nuclear congress, Cleveland Auditorium, Cleveland.

5-10 American Chemical Society, national meeting, Boston.

6-7 Instrument Society of America, second national symposium on chemical and petroleum instrumentation, St. Louis.

7-8 Sixth Gas Compressor Institute, sponsored by University of Kansas and Southwest Kansas petroleum industry, Randall's Cafeteria, Liberal, Kans.

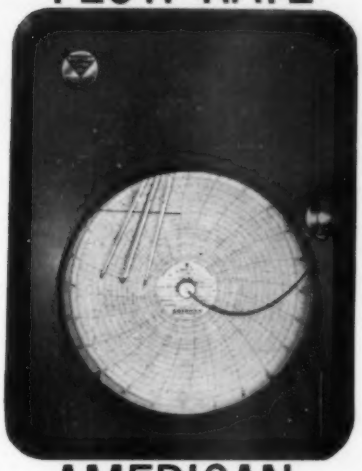
8-9 Western Petroleum Refiners Association, computer conference, Hotel Tulsa, Tulsa.

8-10 American Petroleum Institute, Division of Production, eastern district meeting, Penn-Sheraton Hotel, Pittsburgh.

14 Independent Oil Men's Association of New England, annual meeting, Hotel Statler, Boston.

14-16 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman.

PRECISION MEASUREMENT AT ANY FLOW RATE



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- Manometer body easily cleaned – does not affect calibration.
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15-17	National Petroleum Association, semiannual meeting, Hotel Cleveland, Cleveland.
15-17	American Petroleum Institute, Division of Transportation, annual tanker conference, Jung Hotel, New Orleans.
16-17	Rocky Mountain Oil and Gas Association, midyear meeting, Casper, Wyo.
18-22	Petroleum Equipment Suppliers Association, twenty-fourth annual meeting, Boca Raton Hotel and Club, Boca Raton, Fla.
19-23	American Society of Mechanical Engineers, oil and gas power conference and exhibit, Shamrock-Hilton Hotel, Houston.
22-24	American Petroleum Institute, Division of Production, Mid-Continent district meeting, Herring Hotel, Amarillo, Tex.
22-24	Natural Gasoline Association of America, thirty-eighth annual convention, Baker and Adolphus Hotels, Dallas.
23-24	Sixth annual West Texas oil lifting short course, Texas Technological College, Lubbock, Tex.
24	Society of Petroleum Engineers of AIME, Gulf Coast drilling and production practices meeting, Lafayette, La.
24-25	Society of Economic Paleontologists and Mineralogists, Pacific Coast section, annual spring field trip, Boulder Creek area of Santa Cruz Mountains, California.
26-28	Texas Independent Producers and Royalty Owners Association, membership meeting, Baker Hotel, Dallas.
27-28	Society of Exploration Geophysicists, annual midwestern meeting. Cortez Hotel, El Paso, Tex.
29-30	Western Petroleum Refiners Association, Southwest regional technical-industrial relations meeting, Hotel Paso del Norte, El Paso.
29-30	Pacific Coast Gas Association, operating section, transmission conference, El Mirador Hotel, Palm Springs, Calif.
30-May 1	American Petroleum Institute, Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles.

MAY

1	Fourth annual petroleum accounting conference, sponsored by Wichita chapters of the Petroleum Accountants' Society of Kansas, National Association of Accountants, the Kansas Society of Certified Public Accountants, and the University of Wichita, Lassen Hotel and University of Wichita campus, Wichita.
3-6	Liquefied Petroleum Gas Association, twenty-eighth annual meeting and trade show, Conrad Hilton Hotel, Chicago.
4-5	American Society of Mechanical Engineers, maintenance and plant engineering division conference, Edgewater Beach Hotel, Chicago.
4-5	Independent Petroleum Association of America, midyear meeting, Westward Ho Hotel, Phoenix.
4-7	American Geophysical Union, annual meeting, Washington.
5-7	Purdue University, fourteenth Purdue industrial-waste conference, Purdue Memorial Union Building, Lafayette, Ind.
6-7	Panhandle Producers and Royalty Owners Association, annual meeting, Amarillo, Tex.

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Men who order pipe know it for a fact... that, time after time, LaBarge comes through with amazing speed on rush orders, orders filled from a complete stock of ⅛" to 36" O.D. quality steel pipe in a full range of weights and wall thicknesses. EXAMPLE: An order in the morning for two big carloads was on its way by 4 P.M. the same day... at jobsite 1000 miles away within 72 hours.

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TULSA, OKLAHOMA

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JOURNALLY SPEAKING

Wildcat Count

WHAT'S a wildcat?

This question is the subject of a mild running argument between the Journal and the American Association of Petroleum Geologists.

If you're at all interested in statistics on oil and gas drilling, exploration, and discoveries, you ought to understand the basis of this argument—whether you agree with us or with our critics.

At first glance it would seem that all wells are easily divided into two classes: development wells in known fields, and wildcats or exploratory wells seeking oil or gas where none is known to exist.

But it's not that simple.

There are a good many different definitions of "wildcat," and the differences can get pretty important.

For an example, turn back to the March 9 issue of the Journal, page 88, where we printed a summary of the AAPG's 1958 wildcat report. This says that there were 13,199 wildcats drilled in this country, and the success ratio was 19.46%.

Then compare this with the Journal's annual review and forecast issue (January 26, page 124) where we said there were only 9,588 wildcats drilled and their success ratio was only 14%.

Who's right? The answer is that both are right on the basis of the respective definitions used.

The AAPG includes a lot of wells that we don't think should properly be called wildcats. We have just one classification of w i l d c a t, but the AAPG has five: Outpost or extension test, shallower-pool test, deeper-pool test, new-pool test (within the geographic limits of an old field), and new-field or "rank" wildcat.

We believe that every well, even in the middle of a developed field, is in a sense exploratory, but that it's stretching it a bit, to call all outposts and shallower-pool tests wildcats.

So we stick to a pretty narrow definition. What we call wildcats include what AAPG calls new-field tests plus a relatively few more that are really aimed at a formation not heretofore tested. Thus AAPG tallied 6,950 "new-field wildcats" out of its total of 13,199, against the Journal's 9,588 count of all wildcats. Over the past 15 years the new-field wildcats have comprised only 54% of what the AAPG includes in all exploratory wells.

Are we arbitrary in using such a narrow definition? Not at all. We're following the general practice of the industry.

We get our weekly completions figures from scout checks all over the country. (As a matter of convenience we get them via a few major companies who collect the scout checks in the areas where they operate). Each area has its own official or unofficial definition of a wildcat—it may be 1 mile from settled production in some places, more or less than that in others. But the scouts on the ground know whether or not a well was aimed for an untested or unproducing trap, and the companies they work for insist on screening out those that don't meet a strict definition of wildcat—no matter what they were called by the people who drilled them.

That's why we say we are following industry practice whereas the AAPG is not.

We have no quarrel with AAPG for using a broader definition of exploratory drilling and making extensive detailed analyses of the results. This serves several useful purposes—but we believe that for the purpose of measuring wildcatting and its success ratio our classification serves better.

The AAPG is a bit miffed at this discrepancy. Some of its members have suggested that we label our figures "preliminary," and note that final figures will be published by AAPG.

That we won't do. Our figures aren't preliminary at all. They're just as "final" and just as "official" as AAPG's. It's just that they're prepared on a different basis and using a different definition.

Anybody using drilling and discovery statistics to prove anything ought to know which set of figures he is using and which definition of "wildcat" is the basis of the report.

—Henry D. Ralph

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PERFORATE

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SWAB AND TEST

or use it with a **BAKER RETRIEVABLE BRIDGE PLUG** for as many straddle operations as required... in **ONE ROUND TRIP!**

A

Run tools in together

B

Release Plug, straddle interval, fracture or acidize

Swab and Test

C

Pick up plug, move to next interval

D

here's why it does these jobs better...

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FULL-BORE (Tubing I.D.) permits passage of instruments, or guns; prevents "screen-out" during fracturing operations.

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Producer optimism could offset the imports cut

THERE'S a gimmick in the imports-control plan that puts a big burden on the producing branch of the industry in keeping supply in balance with demand.

This is the allocation of an import quota to every refiner in the country on the basis of his crude runs during each 6-month period.

While the total imports level is geared to demand, an individual refiner can get a bigger slice of the pie by upping his runs of domestic crude. This will generate pressure for higher allowables.

IF CRUDE PRODUCTION increases in response to this stimulus beyond actual market demand, it is obvious what will happen to stocks of refined products. They will increase way out of reason. Products prices will deteriorate, and crude prices will follow the trend.

Of course refiners ought to know better than to do this, but there's an aphorism that making crude available to a refiner is like putting candy in front of a baby. Nine out of ten refinery operators will run all the crude they can get and let the marketing department worry about what to do with the products.

So the only way to maintain balance in the industry is to prevent excessive crude output. Theoretically this should be easier now that the volume of imports is known in advance. But the task of the prorating states will be much more difficult if refiners' nominations are based on the goal of a higher future import quota rather than on the volume of products they can sell currently.

The responsibility is now squarely on producers and the state conservation authorities. No longer can they blame imports for the industry's ills. Problems growing out of oversupply will be traceable directly to domestic production.

This should temper the optimism that has fired producers since the control program was announced. Limitation on imports is no guarantee of higher allowables immediately, nor of stabilized prices at any time. It means simply that one element of supply is now stabilized and predictable.

A HEALTHIER TONE throughout the industry is evidencing itself in many ways, but its basis is more psychological than factual.

This is the season of low demand for all products. Products stocks are on the high side. Refinery runs normally drop in the spring and certainly should drop this spring. So crude production ought to be curtailed somewhat for the next couple of months.

All things considered, no real tightening of the supply situation as a result of the imports order should be expected for quite some time. The scheduled reduction in imports is not a tremendous volume. If domestic supplies increase by more than an offsetting amount, the industry's inventory and price situation will get worse instead of better.

Here's how you can slash Pipeline Operating Costs with a Digital Telemetering System

Compare these facts on communication line costs of a digital telemetering system with those of typical analog telemetering systems and you realize that first-cost becomes an item of minor importance.

FACT 1 Analog systems require additional transmission lines when there are more than 15-20 information points.

FACT 2 A digital system can handle a virtually unlimited number of information points with a single telegraph-grade line.

FACT 3 Continuous analog signals tie up entire lines while digital systems give regular hourly reports (plus automatic alarm signals at any time) on a standard Teleprinter machine. This permits use of line for ordinary Teleprinter communication during all but a few minutes of every hour . . . an extremely worthwhile extra economy.

FACT 4 A digital system utilizing Norwood Controls ElectroSyn servos and Series 2100 encoders, requires only telegraph-grade lines. The output of the ElectroSyn encoder is 3-digit Teleprinter code which can be transmitted without costly conversion equipment.

Typical 25 Year SAVING $1,179,000

And we have the figures to prove it . . . thorough analyses of typical analog vs. digital communication costs. We would welcome the opportunity to discuss them with you.

ADDITIONAL PROFITS are to be gained from increased throughput due to greater reporting accuracy of a digital system which results in lower safety margin requirements.

AND . . . because digital system reliability keeps maintenance costs extremely low, this tremendous annual saving becomes almost pure profit as soon as first-cost has been recovered.

NORWOOD CONTROLS

For full explanation of advantages of digital telemetering systems utilizing ElectroSyn equipment, write for ElectroSyn Bulletin B258 — Norwood Controls Unit, Detroit Controls Division, 942-A Washington Street, Norwood, Mass.

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DETROIT CONTROLS DIVISION

Reserves Bounce Back, Hit New Peak

• U. S. oil industry adds to storehouse of crude, gas liquids, natural gas despite a drop in drilling last year. Comeback in reserves is due to sharp decline in production and revision of previous estimates.

FOR OIL MEN generally 1958 was a poor year. Drilling was down. So was production. But the industry can now claim one bright accomplishment: Reserves reached all-time highs.

The upsurge compensated for 1957, which showed a net decline in reserves for the first time since 1943.

The annual report on reserves made last week by the American Petroleum Institute and the American Gas Association gives this balance sheet at the start of 1959:

... **Crude oil**—30,535,917,000 bbl. proved, up 235,512,000 bbl. over last year and 101,268,000 bbl. higher than the previous 1956 year-end record.

... **Natural-gas liquids**—6,204,018,000 bbl., up 516,658,000 bbl. over 1957 and 301,686,000 bbl. over the former peak at the end of 1956.

These give a total liquid-hydrocarbons reserve of 36,739,935,000 bbl., up 752,170,000 bbl. over 1957 and 402,954,000 bbl. over the 1956 record high.

... **Natural gas**—254.1 trillion cubic feet, an increase of 7.6 trillion cubic feet over 1957, the previous high.

Two factors contributed to the increased reserves:

... **A drop in production** throughout the industry.

... **An increase in volumes** from revisions of previous reserve estimates and extension of old pools.

Discoveries of new fields, or new pools in existing fields, added less new oil than in any year since 1946.

Crude . . . The industry started out 1958 with proved crude reserves of 30,300,405,000 bbl.

Revisions of previous estimates added 954,605,000 bbl. and extension of old pools 1,338,908,000 bbl. This totals 2,293,513,000 bbl., up nearly 285,000,000 bbl. over 1957.

New reserves discovered added another 314,729,000 bbl., about 100,-

(Continued on page 51)

U. S. Crude-Oil Reserves: Thousands of barrels

	Proved reserves 1-1-58	Extensions and revisions	New discoveries*	Production in 1958	Proved reserves 1-1-59	Changes in 1958
Alabama	34,409	10,125	.....	5,948	38,586	+ 4,177
Arkansas	304,959	39,754	1,235	28,083	317,865	+ 12,906
California†	3,759,754	404,689	15,659	313,672	3,866,430	+106,676
Colorado	309,939	124,479	6,081	48,439	392,060	+ 82,121
Illinois	654,746	26,787	6,066	80,010	607,589	— 47,157
Indiana	66,736	15,043	1,301	11,611	71,469	+ 4,733
Kansas	947,484	80,866	13,944	119,860	922,434	— 25,050
Kentucky	138,040	—865	5,000	15,818	126,357	— 11,683
Louisiana†	3,857,569	388,388	77,718	279,682	4,043,993	+186,424
Michigan	49,492	4,387	290	9,201	44,968	— 4,524
Mississippi	359,550	32,931	24,272	38,065	378,688	+ 19,138
Montana	319,991	41,459	5,145	28,796	337,799	+ 17,808
Nebraska	63,059	18,624	7,590	20,031	69,242	+ 6,183
New Mexico	831,744	143,759	14,406	95,788	894,121	+ 62,377
New York	37,533	.....	.....	1,730	35,803	— 1,730
North Dakota	258,221	67,293	2,465	13,900	314,079	+ 55,858
Ohio	68,150	9,166	.....	6,507	70,809	+ 2,659
Oklahoma	1,941,521	139,749	15,377	198,519	1,898,128	— 43,393
Pennsylvania	126,490	.....	.....	6,658	119,832	— 6,658
Texas†	14,555,140	566,771	109,659	909,354	14,322,216	—232,924
Utah	140,034	82,590	650	24,635	198,639	+ 58,605
West Virginia	52,545	1,750	.....	2,191	52,104	— 441
Wyoming	1,419,718	94,885	7,701	113,587	1,408,717	— 11,001
Miscellaneous‡	3,581	883	170	645	3,989	+ 408
Total United States	**30,300,405**	**2,293,513**	**314,729**	**2,372,730**	**30,535,917**	**+235,512**

*Only a limited area is assigned to each new discovery. †Includes offshore reserves. ‡Includes Arizona, Florida, Missouri, Nevada, South Dakota, Tennessee, Virginia, and Washington.

U. S. Natural-Gas Liquids Reserves: Thousands of barrels

	Proved reserves 1-1-58	Extensions and revisions	New discoveries*	Production in 1958	Proved reserves 1-1-59	Changes in 1958
Arkansas	37,140	—659	442	2,773	34,150	— 2,990
California†	305,729	24,222	525	28,157	302,319	— 3,410
Colorado	10,965	11,105	20	822	21,268	+ 10,303
Illinois	11,793	759	.....	1,602	10,950	— 843
Indiana	114	25	.....	20	119	+ 5
Kansas	189,155	15,996	265	5,864	199,552	+ 10,397
Kentucky	5,707	33,002	1,501	2,738	37,472	+ 31,765
Louisiana†	1,019,198	181,797	45,361	50,401	1,195,955	+176,757
Michigan	1,237	287	81	103	1,502	+ 265
Mississippi	54,401	2,951	890	3,060	55,182	+ 781
Montana	7,805	6	40	354	7,497	— 308
Nebraska	7,135	—917	.....	519	5,699	— 1,436
New Mexico	320,548	112,015	1,743	17,068	417,238	+ 96,690
North Dakota	22,700	9,847	.....	1,308	31,239	+ 8,539
Ohio	1,810	—180	.....	12	1,618	— 192
Oklahoma	342,643	41,007	3,442	29,585	357,507	+ 14,864
Pennsylvania	3,460	199	99	73	3,685	+ 225
Texas†	3,271,617	259,799	50,035	189,484	3,391,967	+120,350
Utah	91	14,761	50	3	14,899	+ 14,808
West Virginia	22,912	41,746	3,249	4,621	63,286	+ 40,374
Wyoming	51,165	2,182	507	2,978	50,876	— 289
Miscellaneous‡	35	6	.....	3	38	+ 3
Total United States	**5,687,360**	**749,956**	**108,250**	**341,548**	**6,204,018**	**+516,658**

*Only a limited area is assigned to each new discovery. †Includes offshore reserves. ‡Includes Alabama and Florida.

U. S. Natural-Gas Reserves: Millions of cubic feet

	Proved Reserves 1-1-58*	Extensions and Revisions*	New Discoveries	Change in Underground Storage†	Net Production‡	Reserves 1-1-59	Change in 1958
Arkansas	1,283,022	111,867	36,951	130	43,633	1,388,337	+ 105,315
California¶	8,952,893	378,066	57,047	15,381	436,865	8,966,522	+ 13,629
Colorado	2,380,679	47,143	52,539	— 4,676	126,445	2,349,240	— 31,439
Illinois	166,372	18,877	0	4,299	19,020	170,528	+ 4,156
Indiana	30,952	4,910	0	— 1,362	3,931	30,569	— 383
Kansas	19,295,978	1,497,136	27,027	— 4,391	581,903	20,233,847	+ 937,869
Kentucky	1,225,045	45,738	10,930	1,616	68,000	1,215,329	— 9,716
Louisiana¶	51,435,954	4,122,570	1,911,124	0	2,357,786	55,111,862	+3,675,908
Michigan	444,028	56,501	16,188	— 6,290	12,314	498,113	+ 54,085
Mississippi	2,297,740	408,115	74,627	1,290	183,395	2,598,377	+ 300,637
Montana	670,450	297	38,477	2,261	29,472	682,013	+ 11,563
Nebraska	189,339	— 32,447	1,800	0	15,371	143,321	— 46,018
New Mexico	22,258,009	—528,926	175,465	100	724,628	21,180,020	—1,077,989
New York	93,382	6,375	1,125	— 1,344	3,099	96,439	+ 3,057
North Dakota	743,432	399,699	0	0	18,661	1,124,470	+ 381,038
Ohio	901,814	— 78,420	13,620	14,913	33,875	818,052	— 83,762
Oklahoma	14,259,480	1,698,761	159,370	— 7,545	903,297	15,206,769	+ 947,289
Pennsylvania	853,595	97,266	22,135	1,992	104,974	870,014	+ 16,419
Texas¶	113,084,518	4,598,030	2,799,626	10,519	5,446,950	115,045,743	+1,961,225
Utah	859,294	234,368	2,213	0	37,824	1,058,051	+ 198,757
Virginia	37,521	2,975	525	0	2,600	38,421	+ 900
West Virginia	1,560,930	139,247	30,720	11,136	184,400	1,557,633	— 3,297
Wyoming	3,457,433	153,864	176,170	1,511	139,160	3,649,818	+ 192,385
Miscellaneous§	87,395	6,796	3,419	18,362	7,423	108,549	+ 21,154
Total	**246,569,255**	**13,388,808**	**5,611,098**	**57,902**	**11,485,026**	**254,142,037**	**+7,572,782**

*Excludes gas loss due to natural-gas liquids recovery. †The net difference between gas stored in and gas withdrawn from underground storage, inclusive of adjustments and native gas transferred from other reserve categories. ‡Net production equals gross withdrawals less gas injected into producing reservoirs. Changes in underground storage and gas loss due to natural-gas liquids recovery are excluded. Fourth quarter production estimated in some instances. §Includes Alabama, Arizona, Florida, Iowa, Maryland, and Missouri. ¶Includes offshore reserves.

000,000 bbl. less than 1957 and the fifth straight annual decline in added reserves from new discoveries.

This gives a total of proved reserves added amounting to 2,608,242,000 bbl., a gain over 1957 but still the second lowest year since 1946.

When 1958 crude production is subtracted, net additions to crude reserves are 235,512,000 bbl. The crude production is the lowest since 1954.

Although the 1958 net addition to reserves is considerably greater than the 134-million-barrel decline the year before, it still is the second smallest increase in reserves over the last 12 years.

Gas liquids . . . The industry's showing in adding reserves of natural-gas liquids was better.

Reserves at the start of 1958 were 5,687,360,000 bbl. Revisions of previous estimates added 749,956,000 bbl., greatest such volume since 1946. New discoveries added another 108,250,000 bbl., slightly less than 1957 but still the second best year.

New reserves from these two sources, less 1958 production, resulted in a net addition to reserves of 516,658,000 bbl. This is the best gain since 1950.

The API-AGA figures show that crude-oil production in 1958 was 186,314,000 bbl. below that of 1957. Gas-liquids production was down 10,816,000 bbl.

Even production of natural gas declined by 17,333,000 M.c.f.

Natural gas . . . The reserve performance of the natural-gas segment of the industry was similar to that of the liquid hydrocarbons.

At the beginning of 1958 gas reserves totaled 246.6 trillion cubic feet. Extensions and revisions added 13.3 trillion cubic feet, and new discoveries added 5.6 trillion cubic feet more.

Add 57.9 billion cubic feet gained from net changes in underground storage, and gross added reserves are 19.1 trillion cubic feet. When production is subtracted, net added reserves become 7.6 trillion cubic feet, smallest increase in the last 4 years.

The proved drilled reserves in any pool include the oil estimated to be recoverable by the production systems now in operation. The proved undrilled reserves include reserves under undrilled spacing units which are so close and so related to the drilling units there is reasonable probability they will produce when drilled.

The committee stressed that its estimates of proved reserves cannot be used in measuring the rate at which the reserves can be produced with or without physical waste.

There's Plenty of Oil

. . . Morgan Davis tells AAPG. We'll add 70 billion barrels in 20 years in present fields and lands now under lease.

THE OIL industry will add 70 billion barrels of reserves in the next 20 years—more than double the estimate of present reserves.

This oil will come from "fields already discovered and from acreage already under lease" and will be realized by both primary and secondary - recovery methods.

This optimistic outlook was expressed by Morgan J. Davis, president of Humble Oil & Refining Co. He gave the keynote address before 4,500 attending the joint Dallas sessions of the American Association of Petroleum Geologists and the Society of Economic Paleontologists and Mineralogists.

Davis termed his estimate of future additions to reserves conservative and said the total will come with:

. . . 20 to 25 billion barrels through developing and extending known fields and in improving primary - recovery methods used on them.

. . . 20 billion barrels through improved secondary-recovery methods in projects not yet started.

. . . 35 billion barrels—and maybe more — through exploring untested prospects already located and on undeveloped areas now under lease.

Its source . . . Known fields will provide much of the nation's new oil.

"During the 20 - odd years that crude-oil reserves have been reported by the API, an average of 2.2 billion barrels yearly has been added through revisions and extensions of known fields," Davis said.

Morgan J. Davis

"During the last 5 years, however, this average has risen to nearly 2.4 billion. In view of the large number of fields found in recent years, prospects are quite good that estimates of recovery from known fields by present methods will be raised within 10 years by 20 to 25 billion barrels."

Secondary-recovery prospects add further luster to Davis' outlook.

He cited the Torrey estimate of at least 11 billion new barrels of oil to be recovered from known fields by secondary projects yet to be started. Improved secondary methods also will step up the rate of recovery from one-third to one-half the oil in place. This will provide another 20 billion barrels of reserves without drilling a single well, Davis said.

The Humble executive added that an account must be made of the untested prospects already located and future possibilities on some 350 million undeveloped acres now leased.

He explained "on the conservative assumption that only 2% of this leased acreage will produce oil and that the average ultimate recovery per acre will be 5,000 bbl., the recoverable oil may exceed 35 billion barrels."

Davis asserted he believed the API reserves estimates are too conservative. He said that reserves at the end of 1959 should be about 37 billion barrels of petroleum liquids and 260 trillion cubic feet of gas.

No scarcity . . . Davis took issue with

Bureau Is Optimistic

THE UNITED STATES can count on ultimately bringing 240 billion more barrels of crude to the surface, according to estimates of the Bureau of Mines.

Total amount of crude originally under ground in this country was estimated at about 1 trillion barrels. Despite improved recovery methods, only about 30% or 300 billion barrels of this total is expected to be produced. An estimated 60 billion barrels already has been produced to date, leaving 240 billion barrels for future production.

Bureau statisticians estimated the nation has about 30 billion barrels of presently "proved recoverable reserves," an estimate which closely compares with predictions of the American Petroleum Institute.

those who often declare that major oil fields are becoming increasingly scarce.

Confusion arises regarding current exploration results because of the great increase in newly found small fields. This has caused some people to believe all discoveries now are small.

"It should also be kept in mind that a number of these fields now thought to be small will develop into sizable reserves," he added.

Another view . . . Dr. M. King Hubbert of Shell Development Co., Houston, warned oil remaining to be found in this country may be less than presently believed.

Dr. Hubbert estimated the ultimate amount of crude oil to be found in the United States would be 150 billion barrels.

He estimated that from 25 to 50 giant oil fields remain to be found.

Their discovery may depend on a new scientific inquiry into these fundamental geological questions: Where does oil come from? How does it migrate? What determines its positions of entrapments?

UOP Announces New Molex Process

• Technique is the second to use molecular sieves for upgrading gasoline stocks. Details of the other, Texaco's selective finishing, also are given refiners at the annual WPRA meeting in San Antonio.

TWO PROCESSES using molecular sieves to upgrade gasoline stocks are now available to refiners.

Universal Oil Products Co.'s new Molex process was announced last week at the annual meeting of the Western Petroleum Refiners Association. The paper was presented by D. B. Carson.

On the same program was a paper by W. F. Franz containing additional information on The Texas Co.'s selective finishing process. This was first announced last fall (OGJ, Sept. 15, p. 115).

The Molex process separates all of the normal paraffins as a group from other types of hydrocarbons, Carson said.

While the affinity of molecular sieves for paraffins has long been known, practical problems have made commercial application of the principle difficult.

Molex solves these problems in that:

. . . A single treatment is sufficient to remove normal paraffins throughout the gasoline range.

. . . Continuous processing, with its inherent advantages, may be employed.

. . . Clean separations may be made with a minimum of utilities.

The separation is carried out under conditions which are easily incorporated into normal refining operations. The adsorbent is used in a fixed-bed isothermal manner, and feed and separated product streams are uniform and continuous.

The process thus permits refiners to remove easily and economically the objectionable normal paraffins from their gasoline products, Carson said. The paraffins may then be diverted to other uses or upgraded into desirable gasoline constituents.

Cost factors . . . There are situations where Molex is not competitive with fractionation, other situations where it is superior to fractionation, and still others where it will perform a separation impossible by fractionation.

In a separation such as isobutane from normal butane, or isopentane from normal pentane, the choice will depend on concentrations, capacity, and product purity. On more complex mixtures, Molex has definite advantages, Carson said.

For example, the product from catalytic reforming contains C_5 through C_9 normal paraffins. Removal of these compounds is important if, as in some

Molex Pilot-Plant Separation of Reformate Stock

	Feed	Denormalized Product	Normal Product
Vol. % aromatics	53		
Wt. % n-paraffins			
C_5	4.4	0.4	37.1
C_6	3.8	0.5	30.6
C_7	2.9	0.6	21.6
C_8			
C_9	1.3	0.3	9.4
Total n-paraffins, wt. %	12.4	1.8	98.7
F-1 clear O. N.	89.5	95.0	35.3
F-1 + 3 ml. O.N.	98.2	101.3	65.3

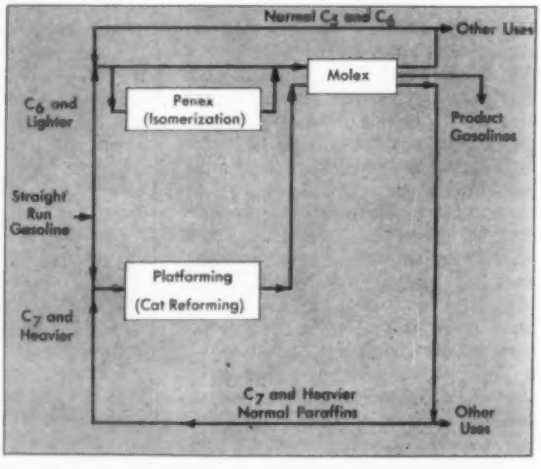
How Molex can be used

MOLEX may be used in the refinery process pattern as shown in the accompanying figure. Straightrun gasoline is fractionated into two streams, C_7 and heavier, and C_6 and lighter.

The heavy material is then catalytically reformed and the total reformate stream processed by Molex. C_7 and heavier normal paraffins are removed from the product gasoline. This stream may be recycled to the reformer or diverted to other uses.

The lighter stream may be handled in either of two ways. The isoparaffin content can be beefed up by a C_5-C_6 isomerization process, or the stream can be sent directly to Molex.

In either case, the normal paraffins are removed from the product gasoline. They can be recycled, if isomerization is employed, or removed for other use, such as jet fuels, solvents, or process feed stocks.



cases, it is necessary to upgrade the reformate.

Separation of these four components by fractionation is not practical, but the Molex separation is accomplished readily, in one operation, as shown by pilot-plant results (see table p. 52).

Payout for a 5,000 bbl. charge Molex unit operating on a similar feed is 1.27 years, before taxes and royalty, Carson said. Installed cost for the unit is $800,000. Denormalized product amounts to 4,570 bbl., and normal product is 430 bbl. Charge F-1 + 3 ml. O.N. is 96.0, and denormalized product O.N. is 99.1.

Pilot-plant results on a full-range straight run stock show a reduction in n-paraffin content from 28.9 to 3.4 wt. %. F-1 + 3 ml. O.N. increased from 53.8 to 65.7 in the process.

Natural-gasoline use . . . Molex seems to be applicable in some natural-gasoline and field-processing applications.

In general, it should work well and be economically feasible for separations involving C_5 and heavier materials, Carson said. It would not usually be competitive with fractionation in the separation of C_4s.

Texaco's process . . . The Selective Finishing Process (TSF) may be used to upgrade gasoline by removing the low-octane-number, straight-chain hydrocarbons, Franz said. The table below shows the response to TSF which might be expected of some typical refinery feed stocks.

In general, stocks will respond to TSF in proportion to their straight-chain isomer content, Franz said. This point is effectively illustrated by the data for the second cat reformate and aviation alkylate. Clear octane numbers for these stocks are quite similar. However, the reformate shows a 4.1 number response to TSF, while the alkylate shows essentially no response.

Reformate splitting . . . A series of Texaco tests shows the advantage of reformate splitting, followed by TSF, Franz said. Greatest octane response is shown by the front end, with 4 to 7 octane number improvement. The bottom end, which is largely aromatic, shows little improvement (about 1 octane number).

Response of Stocks to TSF

Stock	Research Octane Numbers, Clear		
	Charge	Product	Increase
Lt. S. R. Naphtha	69.0	83.7	14.7
Hvy. S. R. Naphtha	44.1	70.6	26.5
Cat. Reformate	87.1	95.3	8.2
Cat. Reformate	94.0	98.1	4.1
Thermal Naphtha	76.0	89.1	13.1
Hvy. FCC Naphtha	88.0	94.4	6.4
Lt. FCC Naphtha	93.8	95.7	1.9
Av. Alkylate	93.1	93.6	0.5
C_3 Poly Gasoline	93.0	93.6	0.6

Similar tests on straight-run naphtha shows that significant improvement may be expected over the whole boiling range. Octane increases ranged from about 5 to 12 numbers. This points to the advantage of upgrading the entire stock in one operation, Franz said.

Cost factors . . . The TSF process is cyclic in nature, and any cost estimate requires the selection of a specific cycle.

Economics for the process have been determined using a two-bed unit, with one bed adsorbing and one desorbing. The cycle lasts 20 minutes on each vessel.

Estimated expense for a 6,660-bbl. TSF unit operating on a mixed hexanes charge containing 22% normal hexane is $0.273 per barrel of charge.

When, in one instance, the 5,180 bbl. per day of isohexanes product was blended into a motor gasoline pot totaling 32,880 bbl. per day, pot octane number rose from 97.5 to 98.3.

This resulted in a cost per research octane-gallon of $0.00241, which compares favorably with other gasoline processes, Franz said.

Turbines Cut Operating Costs

. . . on El Paso Natural's pipelines, but ability to compete is challenged by improvements in reciprocating engines.

THE GAS TURBINE has proven in 6 years' operation that it's a reliable gas-pipeline prime mover with all the requirements for a big transmission system.

It has won a place in a field which still belongs primarily to the reciprocating engine compressor. Now improvements by this conventional prime mover are offering new challenges to the turbine's ability to compete.

This evaluation is based on more than a million hours' experience with 32 turbines on the El Paso Natural Gas Co. system. A look at this machine from all angles was made by A. H. Carameros and B. J. Mathews, El Paso Natural, and W. B. Moyer, General Electric Co., at the ASME Gas Turbine Power conference in Cincinnati.

Here's how the reciprocating engine and gas turbine stack up on installation and operating costs:

. . . Installation costs. A 5,000-hp. gas turbine can be installed for about the cost of two 2,500-hp. reciprocating engines based on sea-level rating.

But a 7,600-hp. turbine can be installed about 20% cheaper than three 2,500-hp. recips. And there's a trend by some companies toward bigger power packages, although it sacrifices flexibility.

. . . Operating costs. Here's where the turbine shines (see table), mainly because of lower labor costs. The gas turbine on El Paso's system has operated 30% cheaper than 1946-50 model reciprocating engines.

Challenges for turbine . . . But the gas turbine's position cannot be considered secure.

Operating Costs: Turbine vs. Reciprocating Engine

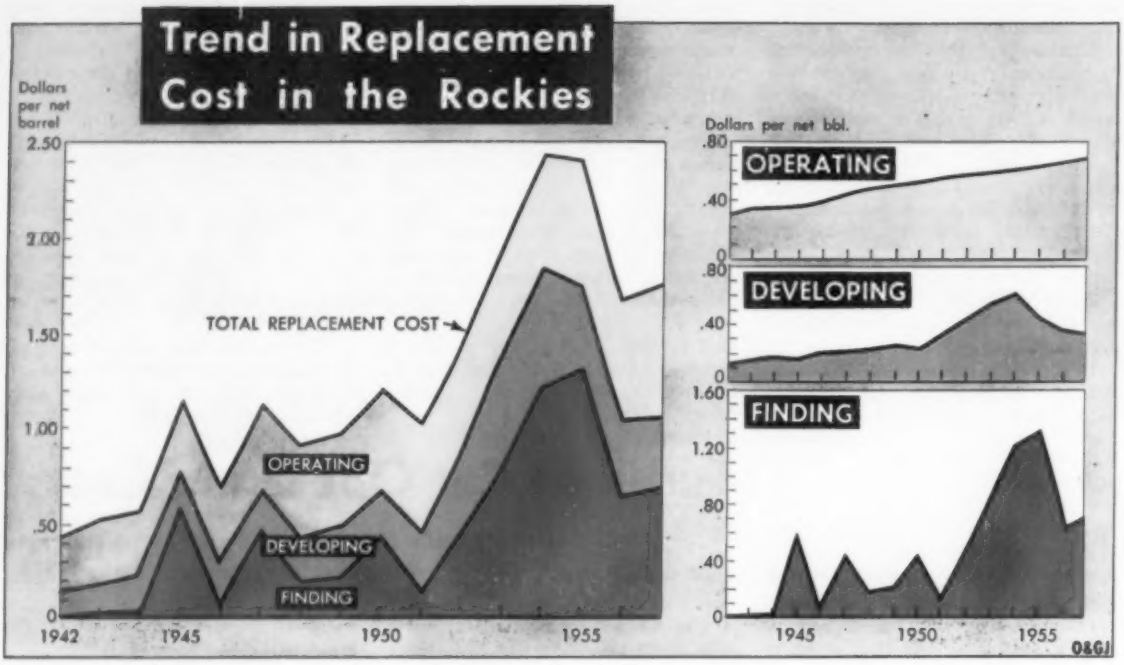
Item—	Gas turbine comparative cost	Net saving
Labor	64% less	21%
Maintenance	20% less	4%
Fuel	2.3% more	−1%
Oil	90.25% less	4%
Miscellaneous	43.5% less	2%
Total		**30%**

From a technical standpoint, a means to monitor the temperature at the inlet of the first-stage nozzle is needed badly. This is the most critical temperature in turbine operation. And a better means of monitoring vibration is desirable.

Fuel consumption also is a problem. When El Paso ordered its first turbines in 1952, fuel consumption compared favorably with reciprocating engines.

Gas turbine consumption was 9.5 to 10.2 cu. ft. per brake horsepower-hour against 8.5 to 9.5 cu. ft. Since then the gas turbine has stood still while engine manufacturers now guarantee 6.2 to 6.8 cu. ft. per brake horsepower-hour. This isn't a deciding factor in choice of prime mover always, but it's becoming important.

Then altitude deration is another problem which may limit its use at high altitudes. Between 4,000 and 6,000 ft. the gas turbine will cost 8 to 12% more than the reciprocating engine.



Rockies Attractive to Oil Hunters

• Costs are a problem, but they're still not as high as other areas, Carter study shows. Replacement cost set at $1.73 a barrel, which is $1.10 under the average crude price in the area.

THE ROCKY Mountain area is still the best place in the interior U. S. to look for oil.

That's based on a study by Carter Oil Co., comparing the Rocky Mountains with previous studies of two other producing areas, Oklahoma and Kansas (OGJ, Aug. 5, 1957, p. 46), and Illinois and Michigan basins (OGJ, Dec. 23, 1957, p. 30).

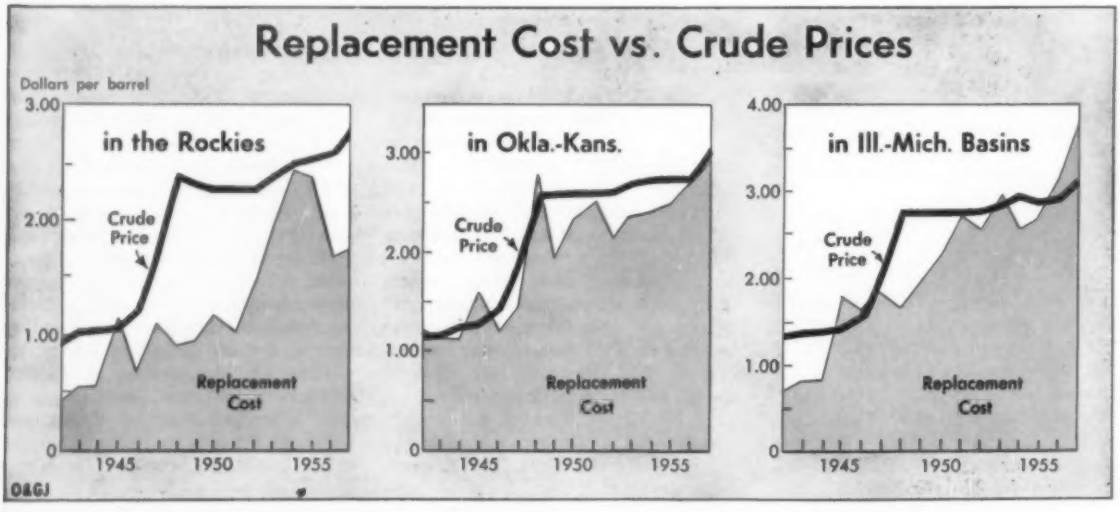
The three studies were combined in a paper presented last week in Dallas by R. E. Megill, senior economist for Carter, at the forty-fourth annual convention of the American Association of Petroleum Geologists.

The study on the Rockies, covering a 16-year period from 1942 through 1957, shows that:

... **Replacement costs,** which increased from 43 cents per barrel in 1942 to a peak of $2.44 in 1954, dropped to $1.73 in 1957.

... **More money** has been spent by the industry since 1950 than has been taken in from the sale of crude and natural gas.

The oil hunter is still getting a better shake in the Rockies, however, since the replacement costs run much



lower than in Oklahoma and Kansas and Illinois and Michigan.

The average price of a barrel of Rocky Mountain crude at the close of 1957—when the replacement cost was $1.73—was $2.83. The costs in Illinois and Michigan, $3.76 a barrel, exceeded the crude price of $3.14. In Oklahoma and Kansas, the costs ran $2.86 a barrel, compared with a price of $3.02.

Deficit . . . The reason for the sharp difference between income and outgo in the Rockies is that it is a new exploration area requiring huge sums for finding and developing new reserves before any money is returned.

During the last 7 years covered by the study, the industry ran up a net deficit of $1 billion, spending $3.6 billion while taking in $2.6 billion.

However, Megill points out, "Sufficient reserves have been added to the Rocky Mountains (5.1 billion barrels) to more than offset this deficit from future profits, but it will be some time before the deficit is erased."

Total costs . . . The study breaks down replacement costs into three categories. They are:

. . . Finding oil. The cost hit a peak of $1.31 per barrel in 1955, but was cut to 69 cents at the close of 1957.

. . . Developing production. The cost, which averaged 13 cents a barrel in 1942, rose to 61 cents in 1954, and then dropped to 35 cents in 1957.

. . . Operating expenses. The cost rose steadily from 29 cents a barrel to 69 cents a barrel during the 16-year period.

Megill, in pointing out the costs of finding oil are increasing in most other areas of the U. S. at a faster rate than development and producing costs, said: "To find more oil at less cost is the challenge to the petroleum geologist."

Pipeline Case Dropped

THE JUSTICE DEPARTMENT has dropped its Supreme Court cases challenging the rate of dividends paid to shipper-owners by Service Pipe Line Co. and Tidal Pipe Line Co.

The suits were based on the 1941 consent decree under the Elkins Act, which limits dividends to shipper-owners of oil lines to 7% of evaluation. A motion to withdrawn the cases was filed with the Supreme Court. Service stipulated that it would exclude from its valuation additions to its system prorated to midyear. Tidal stipulated that it would exclude leased property from its valuation.

A similar case, against Arapahoe Pipe Line Co., is still before the court. Arguments in the Arapahoe case are expected to be heard in April.

watching WASHINGTON

Joe Reilly

• Import plan brings threat of price controls

THE NEW IMPORT PROGRAM will make the oil industry vulnerable to further controls by the federal Government.

Stiffer regulations on oil imports already have set off a howl of protests against price increases which haven't developed. Congressmen from some of the big consumer states were fast to take advantage of the new opportunity to attack the oil industry.

As has been predicted, the mandatory control program includes the threat of price controls in the future. President Eisenhower made the threat a little stronger than had been anticipated, however. The director of the Office of Civil and Defense Mobilization was designated by the President to keep a "constant surveillance" on imports and any future price increases on crude oil or products.

Rep. Charles A. Vanik (D-Ohio) interpreted the presidential proclamation as "Price Control Order No. 1."

In a statement which was both ungrammatical and unrealistic he said: "Thus, by combining restrictions on imports along with restrictions on domestic production, the supply as well as the price of oil and petroleum products is a completely controlled commodity in the United States and the consumer takes it on the chin.

"The Eisenhower administration has succumbed to another Texas tribute at the expense of the American people."

Rep. John D. Dingell (D-Mich.) sees the program as "another administration giveaway to the oil and gas lobby." He predicted price increases on petroleum products within a month.

PRICE INCREASES ARE NOT RULED OUT under the new controls.

The President has no power to raise or lower oil prices even if he wanted to do so. But if the level of imports has any effect on prices, then the President has the power to control prices indirectly by controlling imports.

The new controls are expected to have some effect on prices by allowing them to recover at least some of the ground they lost during the past 2 years.

Capt. Matthew V. Carson, Jr., administrator of the import program, practically invited a price hike. In explaining the effect of the new program he hinted that the recent round of wage increases is expected to bring some price adjustments.

The hint of price controls is said to have been inserted in the import proclamation at the insistence of Vice Pres. Richard Nixon.

Economic aspects of import controls are closely related to the national-security considerations, which are the legal basis for the whole program. Presidential advisers have recognized the fact that increased domestic production won't assure a healthy industry without the proper economic incentives.

In his report, OCDM Director Leo A. Hoegh spoke of the excessive quantities of "low-priced oils" seeking a market in this country.

OFFICIALS IN BOTH GOVERNMENT AND INDUSTRY see the threat of price controls largely as a political gesture. It gives Congress and the consumer some assurance that there will be no runaway in prices.

Although this assurance may pose no immediate threat as far as prices are concerned, it officially places the industry's pricing policies in the realm of politics. The oil industry has been singled out and assigned a government watchdog to keep prices under "constant surveillance."

There was great rejoicing in Washington when lead and zinc prices rose suddenly after imports were brought under federal control. If oil responds the same way, there'll be a furor on Capitol Hill.

New Quotas Hit Big Importers Hardest

• Independent refiners estimate they'll gain 60 to 80 cents for each barrel allocated to them. Carson indicates reasonable price increases will be permitted to permit industry to offset rise in labor and steel costs.

THE OIL INDUSTRY now has a better idea of what life will be like under the new imports plan.

Company quotas announced last week revealed that most major importers will be hit hard by government-enforced cuts in their supply of crude. A few smaller ones will be forced out of business.

The quotas will allow imports of crude and unfinished oil totaling 936,770 bbl. daily. Allocations are 738,570 bbl. in Districts 1-4 and 198,200 bbl. in District 5.

At the same time, these allied developments occurred during the week:

...Price controls will be imposed only for inordinate increases in prices. Capt. Matthew V. Carson told refiners the administration realizes some price increases are necessary. He cited increased labor and steel costs which must be reflected in greater crude prices which in turn may mean some higher product prices.

He affirmed, however, that the OCDM will be watching all price changes closely. What action will be taken in event price raises are termed excessive was not revealed.

...Independent refiners generally approved the new program. They estimated an economic gain of 60 to 80 cents a barrel for each barrel allocated to them. They also feel the move will stabilize prices and create a favorable business climate for the industry.

...Expected opposition was heard in the U. S. Senate when Sen. George D. Aiken, Vermont Republican, said imports controls are "a major contribution to inflation" and contribute to "the growing domination of government bureaucracy over industry and people."

Aiken was joined by three Democratic senators, Wayne Morse of Oregon, S. L. Holland of Florida, and John O. Pastore of Rhode Island, in urging removal of the mandatory controls.

...Canadian interests immediately began pressing for new markets for Canadian oil now restricted from the U. S. market. Upshot may be government approval of the proposed crude pipeline from western Canada to Montreal. Canadians expressed extreme disappointment at the U. S. action of limiting Canadian imports to 70,000 bbl. a day.

Currently, about 295,000 bbl. of Middle East and Venezuelan crude is imported daily into the Montreal market. Although most oil men agree the Montreal market is not a natural outlet for Western Canadian crude, the new import restrictions are causing them to take a second look at the area. In addition, about 90,000 bbl. a day of products is imported into Montreal.

...Venezuela took the controls calmly, although President Romulo Betancourt lodged an official protest. Reason for lack of a bitter protest is that Betancourt considers Venezuela's present oil production of 3 million barrels daily about high enough.

Betancourt hopes to limit oil production as a long-range conservation practice, to make the local economy less dependent on oil by promoting other industry, to avoid a world price-cutting war, and to encourage reinvestment of oil company profits in Venezuela.

Reports persisted, however, that Washington is studying hemispheric aspect of its oil policy and may yet develop some special considerations for Canadian and Venezuelan crude. Informal conversations are expected to begin shortly with the two countries.

The quotas . . . Refiners learned two facts about the quotas.

Inland refiners with allocations must deal directly with coastal refiners who will process their quotas. This will result in a flurry of trading.

Refiners failing to import their full quotas during a given period will not be permitted to carry over the allocations. Extenuating circumstances may be considered, however, by the appeals board.

Tentative quotas were assigned to

Importers and Their Quotas

DISTRICTS 1-4
(Barrels per day)

Established Importers	Voluntary Quota	Mandatory Quota
Atlantic	*55,900	40,160
Aurora	3,500	5,400
Bay Refining	2,700	2,160
Cities Service	27,800	22,240
Clark	2,000	3,220
Continental	5,000	12,610
Crown Central	*9,900	3,860
Danaho	500	400
Delta	3,000	2,400
Dow Chemical	300	.....
Eastern States	*27,900	12,480
Gabriel	6,400	.....
Great Northern	28,100	22,480
Gulf	*111,400	76,080
Hess, Inc.	*35,100	7,840
Ingram	3,500	2,800
International	10,500	8,400
Lakehead	300	.....
Mobil Oil	*76,900	45,760
Murphy Corp.	4,300	3,440
Northwestern	11,500	9,200
Ohio Oil	3,500	4,330
Phillips	10,200	16,790
Pure	5,000	13,540
Republic	4,000	3,200
Shell	6,400	22,760
Sinclair	*60,400	42,400
Southwestern	*6,600	3,700
Standard (Calif.)	*65,400	45,520
Standard (Ind.)	*50,200	33,730
Standard (N. J.)	61,400	49,120
Standard (Ohio)	*8,700	11,130
Sun	43,000	34,400
Sunray	5,000	9,420
Tennessee Gas	3,500	3,410
Texas Asphalt	2,000	.....
Texas City Refining	*11,000	3,200
Texaco	*60,200	37,120
Tidewater	49,200	23,360
United	3,000	2,400
Total	**885,200**	**640,460**

*Includes both crude and any unfinished product allocation under the voluntary program.

New Importers	Mandatory Quota
Advance Refining	260
Allby Asphalt & Refining	260
Allied Materials	250
American Petrofina	4,050
Anderson-Pritchard	3,320
Ashland Oil & Refining	11,300
Bell Oil & Gas	2,070
Berry Asphalt	340
Cactus Petroleum	220
Canal Refining	120
Champlin Oil & Refining	2,830

136 eligible refiners throughout the country, including 76 which had no allotments under the old voluntary import program. The allocations will not become effective until the importing companies apply for licenses to clear shipments through specific ports of entry.

Quotas for companies which did not import under the voluntary program are all for Districts 1-4, covering roughly the states east of the Rockies. The 24 companies assigned District 5 quotas already had allocations under the old program.

Some hurt . . . The new quota formula provides sharp cutbacks for some of the established importers.

Eleven companies have new quotas of less than 70% of the volume of crude and unfinished oils they were allowed to bring in under the voluntary program. Four of their quotas were cut to less than 50%, including two which range between 20 and 30% of the former rates.

As announced earlier, any qualified company which had been importing crude under the voluntary program is allowed an initial quota for crude and unfinished products of at least 80% of its "last allocation" under the old program.

The term, "last allocation," has been interpreted to cover crude quotas only. Restrictions had been recommended for unfinished products under the voluntary program, but the suggested import ceiling for such products had not been classified officially at a quota.

Effect of this interpretation is to give some companies combined quotas for crude and unfinished products amounting to only 80% of their former quotas for crude oil alone. The only companies affected by this ruling are those which qualified to bring in unfinished products under the old program.

Companies which brought in more unfinished products than crude oil were hardest hit by the 80% formula. Hess, Inc., for example, can import only about 22% of its former allotments, and Texas City Refining Co.'s quota has been cut to about 29%. Under the new restrictions, Hess' quota drops to 7,840 bbl. daily from 35,000 and Texas City's quota to 3,200 from 11,000.

Gulf big loser . . . Twelve other companies also will get more than an 80% cutback.

They are Atlantic, 71% of former combined crude - products quotas; Crown Central 38; Eastern States 44; Gulf 68; Sinclair 70; Socony Mobil 59; Southwestern Oil & Refining 56; Standard of California 78; Standard of Indiana 67; Texaco 61; Tidewater 61; and U.S. Oil & Refining 59.

Major companies getting a straight 80% cut include Cities Service, Standard of Jersey, and General Petroleum.

Biggest cuts in barrels per day were Gulf, 35,320; Tidewater, 32,940; Socony Mobil, 31,140; Hess, 27,260; Texaco, 26,940; Standard of California, 19,990; and Sinclair, 18,000.

Five companies which had quotas for crude oil under the voluntary system do not receive new allocations because they did not process crude in 1958 or did not have refinery capacity.

They are Dow Chemical Co.; Gabriel Oil Co.; Lakehead Pipeline Co.; Texas Asphalt & Refining Co.; and Manespo Refining Co. Their former quotas totaled 10,400 bbl. daily.

A few gain . . . Some companies got higher quotas under the new mandatory program.

Among them are Shell, with a gain of 10,280 bbl. per day; Pure, 8,540; Continental, 7,610; Phillips, 6,590; and Richfield, 6,130.

Import quotas for crude and unfinished products on the mainland are

Chanute Refining	20
Cosden Petroleum	4,080
Cooperative Refinery Assn.	3,690
Cotton Valley Solvents	340
Henry H. Cross	330
Cracker Asphalt	150
Delhi-Taylor	3,290
Derby Refining	1,860
Eddy Refining	230
El Paso Natural	1,510
Empire State Oil	290
Famariss Oil & Refining	170
Farmers Union Central Exchange	1,890
Frontier Refining	2,090
Gladewater Refining	10
Great Western Producers	220
Howell Refining	300
Hunt Oil	590
Husky Hi-Power	670
Illinois Farm Supply	470
Indiana Farm Bureau Cooperative Assn.	1,400
S. D. Jarvis	130
Kendall Refining	460
Kerr-McGee Oil	3,990
La Gloria Oil & Gas	1,570
Laketon Asphalt Refining	220
Leonard Refineries	2,710
Lion Oil	3,150
Louisville Refining	820
Macmillan Petroleum	380
Malco Refineries	1,320
Metropolitan Petroleum	1,440
Mid-America Refining	250
Midland Cooperatives	1,290
Monarch Refineries	20
Berry Refining	570
Monarch Refining	250
NAPH-SOL Refining	590
National Cooperative Refinery Assn.	2,870
Paluxy Asphalt	310
Pennsylvania Refining	140
Petroleum Refining	220
Petroleum Specialties	680
Pontiac Eastern	1,390
Pontiac Refining	4,350
Premier Oil & Refining	1,550
Quaker State	930
R. J. Oil & Refining	410
Rado Refining	40
M. T. Richards	20
Rock Island Refining	1,610
Seminole Asphalt Refining	190
Shamrock Oil & Gas	2,270
Sioux Oil	460
Skelly Oil	5,010
L. Sonneborn Sons	160
Southland	480
Suntide Refining	4,140
Texas Calgary	190
Three Rivers Refinery	90
Union Oil	400
Vickers Petroleum	1,510
Vulcan Asphalt	210
West Branch Refineries	200
Western States Refining	500
Total	**98,110**
GRAND TOTAL (1-4)	**738,570**

DISTRICT 5
(Barrels per day)

	Voluntary Quota	Mandatory Quota
Established Importers		
Bankline	2,300	1,840
Caminol	2,800	2,240
Century	1,500	1,200
Douglas	4,400	4,140
Edgington	2,800	2,240
Envoy	1,200	960
Fletcher	5,200	4,160
General Petroleum	23,900	19,120
Golden Eagle	2,300	1,840
Manespo	1,400	
Macmillan	2,300	1,840
Mohawk	2,900	2,360
Palomar	500	400
Richfield	8,500	14,630
Rothschild	2,700	2,560
Shell	30,400	24,320
Signal	4,000	3,200
Socal Oil & Ref.	1,000	800
Standard (Calif.)	*27,800	27,690
Sunland	2,300	1,840
Texaco	*19,300	15,440
Tidewater	*35,500	28,400
Union	†16,300	17,380
U. S. Oil & Ref.	†10,100	6,000
Wilshire	17,000	13,600
Total	**228,400**	**198,200**

*Includes only crude oil. Unfinished products quota included in company's Districts 1-4 allocation. †Includes both crude and unfinished products.

based on refinery input in 1958. The formula in Districts 1-4 allows quotas of 12% of the first 10,000 bbl. in average daily input and 25% for input exceeding 300,000 bbl. In District 5 it allows 6 for input exceeding 200,000 bbl. a day.

Allocations assigned last week are for the period ending June 30. Later quotas will be for 6-month periods.

New controls on imports of finished products will become effective April 1. Applicants will be entitled to quotas in the rate that their imports of finished products in 1957 bore to such imports by all eligible applicants.

Under this formula, imports of residual oil used as fuel are expected to total slightly under 400,000 bbl. per day nation wide. Imports of other finished products will be held to about 60,000 bbl. in Districts 1-4 and about 8,000-10,000 bbl. on the West Coast.

The 936,770 bbl. daily of crude and unfinished oil for which quotas have been assigned does not represent the actual level at which such imports will be held.

The ceiling on crude and all products except residual fuel oil for the first quota period has been set at 757,100 bbl. daily in Districts 1-4 and 211,000 bbl. daily in District 5. Added to this volume will be special crude-oil quotas of about 70,000 bbl. a day for companies relying on Canadian crude.

Companies getting these "special" allocations will lose the quotas assigned last week.

Offshore Drilling to Start Soon

. . . on new Louisiana leases. Humble will kick off program in Eugene Island area; Pan Am will spud Main Pass test.

FIRST STEPS have been taken by three companies to start drilling new Louisiana offshore tracts leased for $43.7-million bonus payments late in February (OGJ, Mar. 2, p. 64).

Humble Oil & Refining Co. and Gulf Oil Corp., successful co-bidders at nearly $6 million on two tracts, will spud their first well in about a month in the Eugene Island area.

Pan American Petroleum Corp. plans to spud a well within 2 months on a $1.8-million tract in the Main Pass area.

The Humble-Gulf leases will be operated by Humble, the two companies decided last week. Humble announced it will do some dredging before drilling but did not state the exact location of the well.

The Humble-Gulf leases are located in Blocks 3 and 4, Eugene Island area, and consist of 7,098 acres near the Louisiana shoreline. Drilling will be in shallow water approximately 25 miles south of Franklin, La., off St. Mary Parish.

Drilling operations by Humble will be conducted under the company's eastern division office at New Orleans.

Humble and Gulf also were successful co-bidders on two other tracts in the West Delta area, but no operator has been selected to drill them. Humble by itself won four other tracts in the Vermilion area.

Pan Am's plans . . . Pan American's well will be located in Block 66, Main Pass area, on one of the four blocks in the area which the company obtained in the February lease sale.

The well site is located east of Romere Pass field and north of Main Pass Block 69 field.

Because drilling will be in water only 1½ ft. deep, considerable dredging will be necessary before spudding. The well will go to 11,000 or 11,500 ft. Pan American is now lining up drilling contractor.

Both Humble and Pan American have applied to the U.S. Army Engineers for permits to install drilling barges and do other work necessary for drilling wells in their lease areas.

These are the only two companies which last week had sought such permits to operate on the new leases. A total of 36 offshore tracts were sold to 17 companies or combinations of companies.

Drilling is required in most of the lease contracts within a year. Failure to drill means a rental payment of half the bonus or loss of the lease.

PROCESSING BRIEFS . . .

U. S. Industrial Chemicals division of National Distillers & Chemical will double the capacity of its new polyethylene plant at Houston. The company announced that its new plant, with a capacity of 75 million pounds yearly, has just gone on stream. The expansion, to be completed in 1960, will give the plant a 150-million pound capacity.

Gulf Coast Engineering Consultants, a new engineering unit of Dow Chemical Co., has opened offices in Houston to serve Dow divisions primarily in the Gulf Coast area.

Skelly Oil's new HF alkylation unit at El Dorado, Kans., is now operating at full capacity, turning out 3,500 bbl. daily of high-octane gasoline. Skelly personnel handled engineering and construction of the unit. The El Dorado refinery has crude capacity of 42,000 bbl. daily.

Work is slated to start soon on a $4.5-million, 9,300-bbl.-daily delayed-coking unit at General Petroleum's Torrance, Calif., refinery. When completed in early 1960, it will boost the plant's coking capacity to 35,000 bbl. daily. Bechtel Corp. has the construction contract.

Engineering and construction of Coastal Products' delayed coker and gas-recovery plant at Suntide Refining's Corpus Christi refinery will be handled by Refinery Engineering of Tulsa. Completion of the 7,000-bbl. unit is scheduled for the end of the year. Coastal Products is owned jointly by Suntide and D-X Sunray.

Gulf Oil's largest electronic computer has been installed in a new two-story wing at the company's Harmarville, Pa., labs. The 704 IBM computer is one of the largest commercially available. The big brain can handle as many as 40,000 additions per second and can multiply or divide about 5,000 times per second. The new wing also houses about 30 computer specialists and serves as an advanced training school for personnel who handle Gulf's other nine computers.

Also for Refiners . . .

IN THE NEWS: Reserves of crude, natural-gas liquids, and natural gas bounce back and reach new peaks despite a drop in drilling last year (p. 49) . . . UOP announces new Molex process using molecular sieves to separate normal paraffins for upgrading gasoline (p. 52) . . . Quotas for importing foreign oil hits largest importers hardest. (p. 56)

PLUS THESE TECHNICAL REPORTS: Liquid methane as a cheaper means of peak shaving (p. 75) . . . WPRA refining quiz on cat cracking (p. 107).

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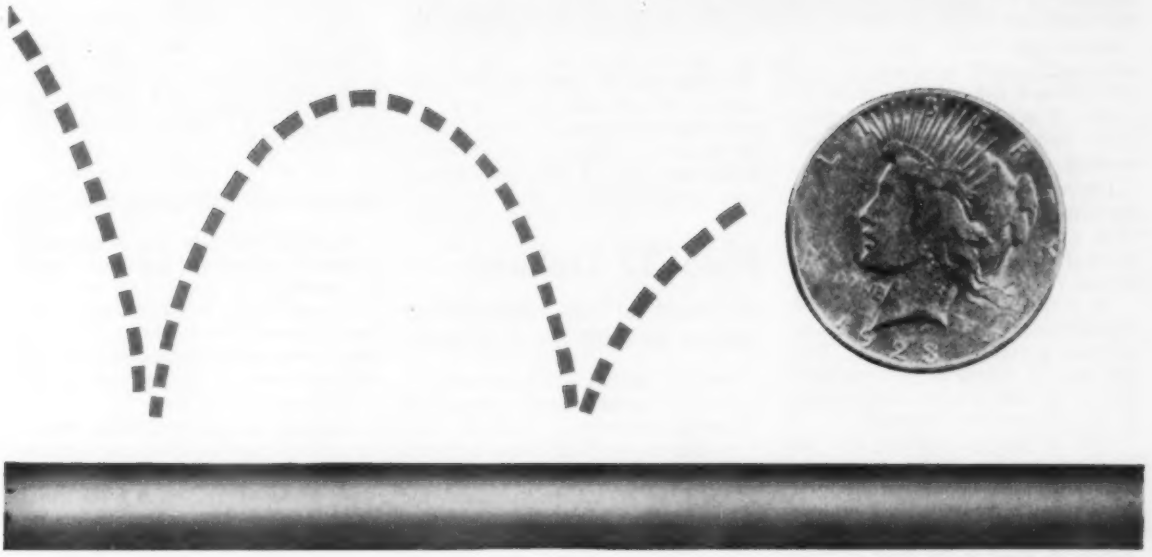

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Gas Is 'Whipping' Boy

. . . in Texas revenue hunt. New taxes, bills to hike old levies hit hopper as governor and Phillips lock horns.

NATURAL GAS continues to be the object of much legislative and gubernatorial attention in Texas.

The state legislature now is considering a myriad of bills which would both raise the gas production tax and levy new taxes on long-term dedication of gas reserves.

Along with this, Gov. Price Daniel fired a blast last week in which he accused "big gas companies" of trying to sabotage his entire tax program.

Daniel said Texas' "most powerful lobby in 20 years" is waging "a carefully planned campaign to place the burden of new taxes on hard-pressed family budgets instead of their own booming corporate profits."

The governor singled out the Phillips Petroleum Co. as a leader among those opposing his tax program. A strong denial came from K. S. Adams, Phillips board chairman.

"It is not correct to say that corporations such as ours are making excessive profits," said Adams. "Phillips had to increase its investment 40% in the last 4 years in an attempt to stay even in total earnings.

"The oil and gas industry and corporations cannot absorb further increases in taxes without seriously impairing their ability to stay in business. "Phillips already pays over $12 million annually to the State of Texas in taxes."

New gas taxes proposed . . . More gas-tax bills hit the hopper in the house this month to join Daniel's pet "dedicated reserves" tax and several others.

Rep. B. H. Dewey, Jr., introduced a bill which would hike the gas-production tax to 10% of wellhead value from the present level of 7%.

He estimates that the bill would raise roughly $18,000,000 annually in new revenue. The gas tax at the 7% level netted the state $41,971,000 during the past fiscal year.

A bill introduced by Rep. Bob Eckhardt, Houston, also a sort of dedicated reserves tax, would levy a new type of sliding-scale tax on gas contracts. The bill is designed in part to encourage higher gas prices. It does this by taxing heaviest the lowest-priced gas.

For instance, the bill would levy a 1-cent per M.c.f. tax on gas bought at 14 cents an M.c.f., while setting a 2.75-cent per M.c.f. tax for gas bought at only 4 cents an M.c.f.

Highway lease block? . . . In other action, three bills were introduced in the house which affect plans of the state highway department to lease for oil and gas development some of its older right-of-ways.

Two of the bills would hold up such leasing, while the third would specifically authorize it.

The oil industry has fought highway department plans to lease right-of-ways in long-developed producing areas as a threat to orderly operation and correlative rights.

It won at least a temporary victory early in March (OGJ, Mar. 16, p. 75) when the recently created Texas Board for Lease of Highway Department Lands canceled a first offering of right-of-ways leases.

Rule 37 Upheld

as court affirms commission permit to drill on 1/5 acre.

PROPONENTS of small-tract drilling scored another major victory in Texas last week.

District Judge C. O. Betts affirmed in Austin the allocation formula set by the Texas Railroad Commission for Normanna gas field in Bee County.

The formula is based two-thirds on acreage and one-third on the well. This has been the commission practice in setting allowables in gas fields where small tracts are involved. It was attacked in court by Atlantic Refining Co., Tidewater Oil Co., and Dudley T. Dougherty.

The suit ensued when Bright & Schiff, Dallas independent, obtained a Rule 37 permit to drill a Normanna field gas well on a 1/5-acre town lot adjoining holdings of the plaintiffs.

Atlantic et al. argued that gas in place under the town lot was much too small to pay off cost of the well, and that the well would drain more than $1,000,000 worth of gas from under plaintiff's leases.

Attorneys for Bright & Schiff defended the allocation formula as consistent with past commission policy and court decisions. Atlantic and the other operators have the option, they contended, of drilling more wells to prevent drainage that might occur.

Second rebuff . . . Whether Atlantic and the other plaintiffs will appeal the district court decision is not certain.

Meanwhile, they have been named by Bright & Schiff as defendants in a $2,825,000 damage suit filed in district court in Beeville, Tex. The suit charges them with illegally hindering and attempting to halt drilling of the Normanna town lot well. The Austin judgment was the second court rebuff administered Atlantic et al.

Earlier this year a district court threw out their suit to rescind the Rule 37 drilling permit issued by the commission to the Dallas operator.

The Normanna cases were watched closely by the industry since small-tract drilling would likely have become a thing of the past in Texas had Atlantic won either of them.

The first would have set a precedent which would have denied permission to drill such wells. The second would have discouraged such drilling by making it unprofitable due to too-small allowables.

Gasser Hit Off Louisiana

PLACID Oil Co. has a gas discovery 55 miles from land in offshore Louisiana.

The well, No. 2 Outer Continental Shelf Lease 0437, is among the most distant ever drilled from the shoreline off Louisiana. It is located in Block 199, Eugene Island area.

Placid, which has three other blocks under lease in the area, did not release details of the completion. Tests were made at 15,536 ft., and total depth was 16,020 ft. Drilling was in 100 ft. of water. The drilling rig has moved to Block 210, Eugene Island.

PIPELINE

Interstate gas lines earned 6.2% more in 1958 than the year before, the FPC reports. Earnings last year totaled $271,546,546 compared with $255,798,193 in 1957. Operating revenues were up 11.7%, from $2,435,045,909 to $2,720,037,341. Taxes were up 12.1%, from $233,-305,523 to $261,614,748. Net utility plant for the 41 pipelines included in the report was $6,374,774,669, an increase of 8.7% over investment at the end of December 1957.

A contract to lay 42 miles of 30-in. for Texas Gas Transmission has been received by Houston Contracting. The project is in four loops in Louisiana. Construction is to begin early next month. Houston also will lay 20 miles of 10-in. concrete-coated pipe in the Atchafalaya Bay area, St. Mary

Offshore LACT Unit

sought by Magnolia. Would be first to handle condensate.

MAGNOLIA Petroleum Co. last week asked permission to install Texas' first LACT system for automatic handling, delivery, and measurement of condensate.

The system would be installed on platforms to handle production from two state leases the company owns 8 miles off Jefferson County in High Island Block 10-L field in the Gulf of Mexico.

R. D. Meyers, Jr., chief gas reservoir engineer for Magnolia, said the company plans to commingle gas and condensate output of the seven wells on the leases, allocate production back to each well on the basis of full stream measurements reflected by meter readings and semiannual g.p.m. tests.

The wells make about 30 bbl. of condensate with production of about 8,000 M.c.f. of gas daily.

Magnolia will install a constant volume automatic gaging tank on the platform to measure the liquids. The only essential differences between the condensate system and those now used for oil production, Meyers said, are the designed working pressure and the size.

The measuring vessel in the installation has a capacity of only ½ bbl., so that about 60 dumps a day would be required. It is designed to operate at the pipeline pressure of 1,400 psi. Conventional safety shutdown devices would insure accurate operation.

SIE Opens Houston Electronics Center

ONLY 14 years ago, Southwestern Industrial Electronics Co. was a big name for a little-known company that had just started business in a one-room office in Houston.

The company's first inquiry for business came in through the mail box. It was a note scribbled in pencil on a penny postcard. But that card led to sale of the company's first complete seismic system.

This month SIE—now grown to 900 employes—finished moving into a new electronics center in Houston. Company officials proudly displayed modern integrated manufacturing facilities covering 300,000 sq. ft. on a 146-acre site in the Houston suburbs.

The center houses SIE divisons in the field of geophysical instrumentation, industrial test instruments, process-control instrumentation, power supplies, automation and control equipment, and military electronics. In addition, the company also engages in heavy manufacture of trucks, trailers, and offshore units for its own seismic exploration and for customers in other industries.

SIE in March 1956 became a subsidiary of Dresser Industries, Inc.

Among industry leaders who participated in SIE's open house were (above left to right) H. A. Herzig, operating vice president of Dresser; J. B. O'Connor, Dresser president; R. H. Parker, SIE executive vice president; Paul Farren, geophysical consultant; and Al G. Nance of Nance Exploration Co.

BRIEFS . . .

Parish, Louisiana, for Tennessee Gas Transmission. Pipe laying will start next week.

A 54-mile products line from Port Everglades to Homestead Air Force Base, Fla., will be built by Florida Pipeline & Storage Co., a subsidiary of Onego Corp., Uniontown, Pa. Local clearances have been obtained to permit the $2-million project to go ahead. The line will deliver 4,000,000 bbl. of jet fuel a year.

A $158-million capital program for 1959-63 is planned by Northern Illinois Gas, Aurora, Ill. This includes $12½ million for a proposed 140-mile 24-in. line from Des Plaines to East Dubuque, Ill., and $32 million for underground storage. Construction expenditures last year amounted to $22,047,000, some $3½ million above 1957.

Northern Illinois has 90,000 pending house-heating applications. Additional supplies now contracted, if approved by regulatory agencies, will provide gas for all on the waiting list.

Increased take of Canadian gas is planned by Pacific Northwest Pipeline through a proposed 17-mile 30-in. loop of its Spokane-Coeur d'Alene lateral. Pacific Northwest has asked the FPC for a permit to import 151,731 M.c.f. daily from Westcoast Transmission. Gas would be transported by Pacific Gas Transmission, a Pacific Gas & Electric affiliate, to Pacific Northwest at the British Columbia border. Pacific Northwest proposes to sell this amount to parent El Paso Natural at Ignacio, Colo.

Also for Pipeliners . . .

IN THE NEWS: Natural-gas reserves reach new peak of 254.1 trillion cubic feet (p. 49) . . . Turbines have cut operating costs on El Paso Natural's pipelines, but their ability to compete is challenged now by improvements in reciprocating engines (p. 53) . . . French cabinet approves 419-mile big-inch crude line from Mediterranean to Strasbourg (p. 71) . . . Russia is now moving gasoline through a new products line from Omsk to Novosibersk (p. 71).

A complete list of pipeline projects is carried in the last issue of the month. Current projects are carried in Pipeline Briefs.

PLUS THESE TECHNICAL REPORTS: Liquid methane as a cheaper means of peak shaving (p. 75) . . . How Bechtel double-joints big pipe (p. 83).

Esso May Vote on Hoffa Bid

. . . to let teamsters represent employes at Baton Rouge. Head of local wants election, OCAW set for bitter fight.

WORKERS AT ESSO'S Baton Rouge refinery may hold an election to decide whether to affiliate with James Hoffa's Teamsters International Union.

Marvin Holly, president of the 4,000-member Independent Industrial Workers Association at the refinery, said sentiment is "pretty strong" for quitting the independent union ranks and joining the Hoffa organization.

Holly said he is making no recommendation. He expects the union's officials to ask the NLRB to hold an election.

The Teamsters issue has arisen during long-deadlocked talks with Esso management over a new contract. The old contract expired July 20. Negotiations have bogged down on management's proposal for creation of a "refinery mechanic" classification.

Contract discussions continued last week but the question of Teamster affiliation hovered over the talks.

In Denver, headquarters for the Oil, Chemical and Atomic Workers Union, it was evident OCAW leaders are not taking Hoffa's threat sitting down.

OCAW challenge . . . "We will continue to protect our interests," a spokesman said. "We do not intend to let others get our members by default. We consider ourselves the most competent union to represent employes in oil refineries."

Facts sheets calling the OCAW "the oldest and strongest union in the petroleum industry," were given Baton Rouge workers at gates during shift changes.

The OCAW-Teamsters battle is the first major scrap involving the AFL-CIO affiliate and the Teamsters since Hoffa's union was expelled from the AFL-CIO in 1957.

The OCAW expects the battle to spread to other major refineries which have been objects of Hoffa's organizing attempts. These are Bayway, N. J., Esso; Paulsboro, N. J., Mobil Oil; Wood River, Ill., Indiana Standard; and Baytown, Tex., Humble. The Teamsters also are trying to get representation at numerous other smaller plants.

Hoffa made a personal pitch to the refinery workers on March 13 at a jam-packed meeting of some 1,500 persons in Baton Rouge. Despite loud protests from the Louisiana AFL-CIO organization and others in the state, Hoffa gave a lengthy speech and was well applauded.

He recited his ambition to bring into the Teamsters all the independent unions representing Standard Oil Co. (N. J.) refineries.

Exploitation charged . . . "Standard Oil will continue to exploit workers in every way it can until the majority of refinery workers in all parts of the nation have joined together," Hoffa said.

Holly, while not committing himself to Hoffa, said he favors an election on the question of affiliation. It was Holly who invited Hoffa to speak at Baton Rouge.

Holly also said that if the OCAW wants a spot on the ballot, he would welcome it. But, he added, "I don't think they would have a chance."

J. Elro Brown, district OCAW agent at Houston, said recently his union would contest the Teamsters in any election which might be held at Baton Rouge.

King Ranch Plant

will be built by Hudson. It's part of gas program.

HUDSON ENGINEERING Corp., Houston, will build Humble Oil & Refining Co.'s huge King Ranch gas-processing and cycling plant in Kleberg County, Texas.

The contract is the last to be let in a $70-million program to gather gas from nearby fields, process it, and pipe the liquid products to the Houston area. Humble recently let the contract for a 238-mile, 30-in. gas pipeline to Panama, Inc., Houston.

The gas plant, to be located 14 miles southwest of Kingsville, will be capable of recovering some 28,000 bbl. daily of liquid products while processing 200 million cubic feet of gas daily.

Hudson will begin contruction shortly and have the project completed by late 1960. A portion of the plant may be in operation by the end of this year.

the JOURNAL *said . . .*

50 years ago

March 20, 1909

Gaffey well No. 108 at Spindletop came in for about 400 bbls. of oil. It is 1,000 ft. deep and so close to the Cissel lease that one leg of the derrick is on that tract.

Donzell Stoney of San Francisco has been made general manager of the sales and marine department of Union Oil Co. of California. William H. Workman of Los Angeles is new manufacturing-department manager.

Standard Oil Co. of Indiana was found innocent in Chicago federal court of a charge of accepting rebates from Chicago & Alton Railroad on oil shipments from Whiting, Ind. to East St. Louis, Ill.

Dan W. Patton, chief engineer for Sapulpa & Interurban Railway Co., announces an interurban line will be built from Sapulpa to the Glenn Pool area.

25 years ago

March 22, 1934

Whacking away at what it terms lawlessness, code evasion, and chiseling, the Federal Petroleum Administration prepared to defend orders of its representatives regulating crude oil production. It also enjoined a Detroit company from selling gasoline below posted prices and giving away glassware and earthenware to attract customers.

The Petroleum Labor Board ruled in a Magnolia case that a company union cannot represent employes in bargaining negotiations.

The states of New York, California and Pennsylvania with low gasoline taxes—3 cents a gallon—in 1933 led all states in total sums collected from these taxes, the API reports.

10 years ago

March 24, 1949

Hearings will open next week on bills by Rep. Oren Harris of Arkansas and John Lyle of Texas to deprive the FPC of any control over production and gathering of natural gas.

The Navy has revised its thinking on oil supplies for war. It now believes military needs can be met without a multi-billion dollar plan for a synthetic-fuels industry. Reason: Shortages of 1948 have turned into surpluses.

The State Department has flatly refused to recognize Romania's seizure of Standard Oil Co. (N. J.) oil properties.

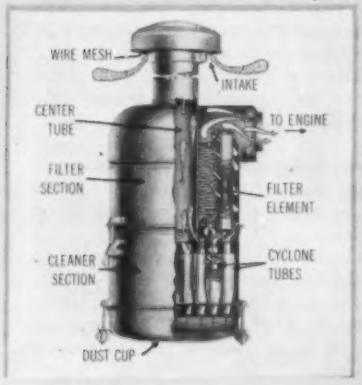
The Longview, Tex., refinery of Danciger Oil & Refining Co. has been sold to Italy by W. C. Berry & Associates, Tulsa. It will be dismantled and erected in Augusta, Sicily.

SPECIAL REPORT TO CATERPILLAR OWNERS:

Parts you can trust. Dependable round-the-clock service

New Caterpillar dry-type air cleaner: CUTS SERVICING TIME 75% AVAILABLE FOR FIELD INSTALLATION on D8, D9, DW20, DW21 and No. 583

AIR-BORNE DUST is the deadly enemy of your engine's vital parts. Now, the new Cat dry-type cleaner gives positive protection against the entrance of harmful dirt—and its simplified servicing requires only about 5 minutes instead of 20 as with the oil-bath type!



THE NEW CATERPILLAR DRY-TYPE AIR CLEANER removes 99.8% of the air-borne dust from the intake air, even under the most severe conditions. Air enters through the stack cap where wire mesh screens out leaves and similar trash. Then the air passes down the center tube and swirls down the cyclone tubes. Centrifugal action throws the dirt against the sides of the tubes. From here 95% of the dirt falls through the funnel section into the dust cup, and the relatively clean air passes on to the resin-impregnated, cellulose filter. This element removes the rest of dirt and allows only clean air to enter the intake manifold. Filter elements can be cleaned and have lasted 3,000 hours without loss of efficiency.

SERVICE COSTS ARE SLASHED! Here is the experience of WEGCO Equipment Rental, Inc. of Cleveland, N. C., as told by the Superintendent of Maintenance, Mr. George R. Bell, "The dry-type cleaner saves us money. We have to clean our air cleaners daily because of dusty conditions. The oil-bath cleaners take about 20 minutes to clean and 5 quarts of oil. That's 60 cents in labor and $1.28 worth of oil, a total of $1.88 per machine. This dry-type cleaner takes only 5 minutes to service—about 15 cents labor. It saves us $1.73 on each machine every day."

SERVICE TIP: To empty dry-type cleaner dust cup, simply loosen wing nuts, remove cup, empty and replace. Occasionally the filter element will need cleaning. Merely remove it, blow off dust or wash in water, then replace.

YOUR CATERPILLAR DEALER has the full story on how much *you* can save by changing to the new and efficient Cat dry-type air cleaner. Remember, he stands behind every part he sells. See him today!

Caterpillar Tractor Co., Peoria, Illinois, U.S.A. **CATERPILLAR**

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BIGGEST miscible drive is Magnolia's in Parks Pennsylvania field, West Texas. Project covers 8,000 acres.

Miscible Drives: A Growing

Journal study shows:

- There are 39 projects planned or operating in eight states, and the number is growing fast.
- Early results show there is still a lot to learn about miscible recovery. Increasing areal sweep efficiency is a big problem.
- The method also is being used as a tertiary tool.
- Six projects have failed, but oil men are still enthusiastic about the future of the method.
- The successful projects are turning up valuable results that will guide operators in planning future programs.

THE MISCIBLE DRIVE, as a new oil-recovery tool, is coming of age.

Actual field performance data now is beginning to come in in quantity from such projects for the first time. And operators already are making good use of their first experiences, whether good or bad, in planning new projects.

Some tests have flopped. And the failures have tended to temper what many operators feel was general overenthusiasm over prospects for miscible recovery a couple of years ago.

But the failures have been helpful, too, in throwing some light on where miscible drives aren't practical.

The prevailing feeling now about miscible recovery appears to be one of cautious optimism.

Operators generally feel that the miscible technique holds promise.

Miscible drives are costly. Because of this such operations will many times be rejected in favor of water floods which will produce less oil at less cost.

This, however, could change, too. Many operators now have misgivings over what appears to be a poor areal sweep efficiency of the miscible drive. If the sweep can be improved in some way, miscible projects could be applied much more widely.

There is a growing feeling that water injection in conjunction with the miscible drive may be the answer. Projects of this type already are under way. Success of these projects would give the miscible techniques a tremendous boost.

Current projects . . . An exhaustive Journal survey conducted over the past several weeks shows 39 miscible-recovery projects now in operation or starting this summer in the United States. Along with these there are at least three more in Canada and perhaps as many more scattered over the rest of the free world.

The oldest miscible drive now active is the high-pressure gas project launched by Atlantic Refining Co. in July 1949.

Another was started in 1952, two more in 1953, and one in 1955.

Industry interest in the recovery method began to quicken in 1956 when five projects were launched.

And the peak year so far came in 1957 when operators kicked off 14 miscible drives of those now operating. Seven drives started last year are still active. And eight either already have gone into operation this year or will by summer.

It's possible that, before the year is out, as many drives will get under way in 1959 as in 1957.

1. The Problems

Though operators have learned a lot from test projects to date, they all agree in one thing—they still have much to learn.

There is, for example, about as much disagreement now as 2 years ago over how much LPG is needed in the slug-type drives. Indications now are that LPG needs will vary greatly from reservoir to reservoir. Whether gravity segregation will take place is still not certain, though most operators feel it won't be a major factor.

Operators also find room for argument over such questions as:

. . . **Will a miscible drive work** in a very low-pressure reservoir (100-600 psi.)?

. . . **How much free gas** can there be in the reservoir before it becomes a deterring factor?

. . . **How important are** formation dip, structural relief, and fractures in the reservoir rock?

Information is funneling in from active field tests which should help provide the answers.

Water being used . . . Water already is being injected in three miscible drives in an effort to improve areal sweep efficiency.

One of these is operated by Atlantic in the San Andres under its Boyd lease in Slaughter field of West Texas (OGJ, June 16, 1958, p. 68). Water injection also is being tried by the Haynesville Operators Committee in the Southwest Lower Pettit reservoir of Haynesville field in Louisiana.

The third case where water is being used in hopes of increasing areal sweep efficiency is Continent Oil Co.'s drive in the Lakota "B" reservoir of Meadow Creek field in Wyoming.

Atlantic is convinced there are few cases where an LPG drive or enriched gas drive will prove a better economic bet than a water flood unless these drives can be made to cover more of the reservoir.

It thinks much fingering and channeling that normally would occur in such a project, however, may be prevented by injecting either water or water and gas alternately after the LPG and gas (or rich gas).

Such tail-ending, it thinks, will hike oil recovery by lowering the pay zone's relative permeability to gas by interfering with the gas flow and increasing the average viscosity of the flowing system pushing the oil.

Such projects should recover up to 90% of the oil originally in place in a suitable reservoir, Atlantic estimates.

Tool for Oil Recovery

The Atlantic project . . . In Slaughter field, Atlantic has injected 120,000 bbl. of water following propane and gas in one of three input wells.

The other two inputs still are injecting gas at a rate of about 6,000,000 cu. ft. daily but will switch over to water later this year.

Several producing wells have shown a characteristic dip in gas-oil ratio. No outstanding increases in oil rate have shown up. And the project is too young to permit the company to draw any definite conclusions as to its success.

The Continental project . . . Continental is experimenting with an unusual program involving use of alternate slugs of LPG and water in its Meadow Creek project.

The company resorted to this technique following failure of a more conventional LPG slug drive chased with gas.

The reservoir, a small pool with average pressure of only 260 psi., initially did not look attractive as a candidate for a miscible drive. But Continental decided to experiment, partly because it had surplus propane and butane in the area. The small size of the pool also was a factor in that it permitted Conoco to run a test at relatively small cost.

It began injecting the LPG 2 years ago. Within a year, LPG had broken through the oil bank in three areas.

Company engineers decided to shut in the reservoir and build up pressure to 850 or 900 psi. with alternate slugs of water and LPG. Pressure now has built back up to about 400 psi. It will take another 1½ years to reach the desired level.

Engineers on the project aren't sure they can create an LPG front with such injection. Successful or not in this effort, Continental feels the project worthwhile in that it has learned much about miscible mechanics.

One prime Continental conclusion —a miscible drive won't work in a very low-pressure reservoir.

The Haynesville project . . . This one, perhaps, is the most unusual of all miscible drives now active, as well as being one of the oldest.

It is conducted by the Haynesville operators committee. The subject, Southwest Lower Pettit reservoir, is a thin lens-type pool at 5,300 ft. with net pay averaging only 3.4 ft. The pool is part of a unit operation taking in 3,257 surface acres. Average pressure of about 1,100 psi. has been been maintained throughout the program.

Prior to the launching of the miscible drive, the reservoir had been subjected for years to conventional dry gas injection.

In March 1953, the operators committee began injecting dry gas enriched with liquid propane and ethane in a well formerly used as a dry-gas injection well in the middle of the pool.

Following the rich-gas phase, operator injected 280,000 bbl. of liquid ethane and propane over a period of months through the same well.

Then in September 1957, this well was shut in. Another well, this time on the edge of the field, was converted to input service and water injection started through it.

This reversed direction of the LPG front and started moving it back the other way. Underground, the flowing system resembles that in Atlantic's Boyd project. From the point of water injection, the flowing fluids are water, gas (from the original gas program), enriched gas, liquid LPG, swollen oil, and virgin reservoir crude.

The unique feature is that all fluids were injected in reverse order except for the water, which was injected in a different area.

The committee feels it will take another 6 years to completely flood the reservoir. Plan now is to add more water-injection wells as water shows up in more producers and to eventually wind up with a line-drive type of water injection pattern. Oil production is expected to peak at about 15,000 bbl. a month in roughly 2 years. This would be about triple the present production rate.

The committee estimated it would get only about 35% of original oil in place from the reservoir with a conventional water flood. It jacks up the recovery estimate to 60% using the present program—and feels this figure is conservative.

2. Use as a Tertiary Tool

Some operators are willing to gamble that a miscible drive can give them a third crop of oil.

One miscible drive already is under way in a field swept previously by a water flood. Two others will be launched this summer where highly successful floods have played out.

Sunray project . . . The project already started is being carried out by Sunray Mid-Continent Oil Co. in Eram field of Okmulgee County, Oklahoma. The operation involves injecting LPG and pushing it with gas.

Sunray so far is withholding information on performance.

Phillips project . . . In Greenwood County, Kansas, Phillips Petroleum Co. as unit operator will launch this summer a similar project in the Bartlesville sand under the Burkett Unit.

This field was discovered in 1936. It was water flooded in 1942 and has proved a "story book" success.

The operation might more than double the volume of oil recovered so far with the miscible drive-boosting total recovery to roughly 22,000,000 bbl. from the present total of 10,313,000 bbl.

Water saturation currently in the project area is about 75% of pore space. Operator will reduce this to

Looking for the Right Combination

OIL MEN are trying a bit of everything in trying to come up with the best type of miscible drive.

The most popular approach in the 39 projects now active is using the LPG slug method. In this type of flood, LPG is injected followed by dry gas. Twenty-four of the 39 projects are using this technique.

Six of the active projects are using enriched gas drive (or condensing gas drive). These inject either rich casinghead gas or dry gas enriched by adding liquid ethane, propane, or butane.

Three projects inject gas at a high pressure to achieve the miscible front. Four are purely solvent floods, injecting only LPG. One is trying out alternate slugs of LPG and water. And one appears to combine the LPG slug and enriched gas drives with water injection.

For a rundown on these 39 projects, see the table beginning on page 66.

Journal Box Score on the 39 Miscible Drives in the U.S.

Operator	Field, County	Type of project	Status	Date started	Degree of success	Acreage
			CALIFORNIA			
Ohio Oil Co.	South Coles Levee, Kern	Enriched gas drive	Inj. rich gas	April 1957	Good to date	Not reported
Standard Oil of California	Midway Sunset, Kern	LPG slug (propane)	Active	Not reported	Results encouraging so far	Not reported
Sunray Mid-Continent Oil Co.	Newhall-Potrero, Los Angeles	LPG slug	Active	Not reported	Not reported	Not reported
Union Oil Co.	Guijarral Hills, Fresno	LPG slug (propane)	Planned	Starting this year	.....	Not reported
Western Gulf Oil Co.	Paloma, Kern	LPG slug (propane)	Inj. propane	Not reported	Not yet apparent	Not reported
			KANSAS			
Phillips Petroleum Co.	Burkett Unit, Greenwood	LPG slug, gas, following water flood	Planned	Starting this year	.....	Small pilot
			LOUISIANA			
†Atlantic Refining Co.	Neale, Beauregard	High-pressure gas	Inj. dry gas	Early 1956	Early results "very encouraging"	Not reported
Haynesville Opr. Committee	Haynesville, Claiborne	Combination (ethane, propane) LP slug, enriched gas driven by water	Active	March 1953	Good so far	3,257
			NEBRASKA			
Ohio Oil Co.	Johnson, Cheyenne	LPG slug, gas	Active	June 1958	Not yet apparent	Pilot
			NEW MEXICO			
†Sunray Mid-Continent Oil Co.	Bisti Gallup San Juan	LPG slug, gas	Inj. dry gas	Aug. 1957	Good	160 (pilot)
			OKLAHOMA			
Carter Oil Co.	Seminole City, Seminole	LPG slug, gas	Injecting gas	May 1953	Results favorable, final analysis near	Not reported

about 35%, the connate water average.

Then roughly 18,000 bbl. of propane will be injected in one input well at the north end of the unit. The slug will be driven by about 54,000,000 cu. ft. of dry gas.

If results of the pilot are good, the project will be extended over the entire 1,000-acre field.

Primary recovery from the field to 1936 was 4,455,000 bbl. Flood recovery since has been 5,857,000 bbl. Little oil has been produced from the field, however, since 1957.

At present, Phillips plans to make no effort to recover the propane in that it would be a difficult job not justifiable economically. Propane volume involved, too, is tiny compared to possible oil recovery.

Atlantic project . . . While Phillips has a number of partners in the Kansas operation, Atlantic will go it alone in an upcoming project in South Ward field in West Texas.

Atlantic is awaiting approval, almost certain to come, of the Texas Railroad Commission to follow a successful water flood with a miscible drive in the Yates sand under its 320-acre Johnson lease.

Though the Phillips and Atlantic projects are similar in many respects, there are some major differences.

Atlantic, for instance, will make no attempt to reduce water saturation of the pay before launching its project.

Secondly, Atlantic in South Ward, as in Slaughter, will inject first LPG then gas, then water. In the later stages, thus, the project would become somewhat of a water cycling operation with water (and oil) being produced at one end and water injected at the other.

Many unknows . . . Companies venturing into such tertiary miscible projects are confronted with even more unknowns than in the more conventional miscible drives.

LPG volume needed is one problem. Hardly any data is available regarding how fast an LPG bank will dissipate on continued contact with water.

Costs will run extremely high, too. Tremendous volumes of water must be handled and treated. In many cases, however, facilities for water handling will already be available.

Atlantic is betting that LPG amounting to roughly 3% of hydrocarbon pore space will be sufficient to do the job—about the same as it feels is required normally for a conventional LPG slug drive.

Operator	Field, County	Type of project	Status	Date started	Degree of success	Acreage
Oklahoma, con't.						
Continental Oil Co.	Short Junction, Cleveland	LPG slug (butane and propane) gas	Inj. gas	Sept. 1957	Not yet apparent	640 (pilot)
Shell Oil Co.	Elk City, Washita	LPG slug, gas	Active	July 1957	Good to date	Pilot
Shell Oil Co.	Elk City, Washita	LPG slug, gas	Active	Just starting	Not yet apparent	Pilot
Sunray Mid-Continent Oil Co.	Eram, Okmulgee	LPG slug, gas, following water flood	Active	Not reported	Not reported	Not reported
Tekoil Corp.	Sunflower, Lincoln	LPG slug, gas	Planned	To start this summer	.....	40 (pilot)
Tekoil Corp.	East Washunga, Kay and Osage	LPG slug, gas	Planned	To start this summer	.....	40 (pilot)
		TEXAS				
Atlantic Refining Co.	Block 31, Crane	High-pressure gas	Inj. dry gas	July 1949	Results excellent	6,000
Atlantic Refining Co.	Slaughter, Cochran	LPG slug (propane), then gas, then water	Water injection started	May 1958	Not yet apparent	1,247
Atlantic Refining Co.	South Ward, Ward	LPG slug, gas, water, following successful water flood	Planned	To start Summer 1959	.....	320
Cities Service Oil Co.	Panhandle, Gray	LPG slug (butane), gas	Inj. gas	July 1957	Good so far	320 (pilot)
Cities Service Oil Co.	Columbus field Unit, Colorado	High-pressure gas	Inj. dry gas	Aug. 1957	Results encouraging so far	Pilot inj. through one well to date
Cities Service Oil Co.	Wilbarger County Regular, Wilbarger	LPG slug (propane), gas	Inj. gas	Oct. 1957	Not yet apparent	26 (pilot)
Continental Oil Co.	Rincon, Starr	LPG slug, gas	Inj. LPG	Oct. 1958	Not yet apparent	120 (pilot)
Humble Oil & Refining Co.	Bronte, Coke	Enriched gas drive (inj. rich casinghead gas	Inj. rich gas	Late 1956	Not yet apparent	1,300

Continued on next page.

The company has done a tremendous amount of research and engineering work prior to deciding to go ahead on the South Ward project. The results have convinced company engineers that they can make the venture a profitable one.

Here, too, the company thinks, much care must be taken in choosing a reservoir. There must be enough residual oil left by the water flood to justify a following miscible drive.

It isn't likely, one Atlantic engineer, thinks, many reservoirs can qualify.

3. Some Have Failed

Though most of the 39 miscible drives appear to be performing well, at least half a dozen projects have been abandoned.

Reasons for their abandonment were varied, and, as a whole, do not reflect poorly on the method.

Four of the six injected only LPG. The other two fell in the gas-driven-LPG slug class. Here's a rundown on the six abandoned projects:

... **Pan American Petroleum Corp.** dropped its LPG slug drive in South Leonard field of Wagoner County, Okla. The project was not considered successful. However, the company reportedly concluded that the reservoir was not well suited to a miscible drive. Evidence that the firm hasn't lost faith in the method lies in the fact that it is participating now in five more miscible drives of which it is operating at least two.

... **Wherry & Green,** Houston independent, attests to learning "an expensive lesson" in a project started in the Navarro sand of Taylor-Ina field in Medina County, Texas, in September 1956.

Operator injected butane and propane for 6 months then injected dry gas for a year. Severe LPG channeling and breakthrough occurred, and the operation was suspended.

Operator here, too, feels that the reservoir was not suited to a miscible drive due to fact that its crude was a low-gravity type and highly viscous.

... **Phillips** abandoned a project in the Spraberry sand of Spraberry Trend Area field of West Texas in which it injected only LPG. The operation was classed as an experiment launched only because the company had LPG in the area with no market.

Oil recovery was improved in the test area. Abandonment was due partly to development of a market outlet for LPG and partly to a lack of pump capacity needed to inject more product.

... **Frank Buttram,** Oklahoma City

Miscible Drives in the U.S., Cont.

Operator	Field, County	Type of project	Status	Date started	Degree of success	Acreage
Texas, con't.						
Humble Oil & Refing Co.	Bronte, Coke	Enriched gas drive, (inj. rich casinghead gas)	Inj. rich gas	Late 1956	Not yet apparent	460
Humble Oil & Refining Co.	Seeligson, Kleberg	Enriched gas drive (half and half mixture propane and separator gas)	Active	March 1957	Good so far	648
LaGloria Unit (Magnolia, opr.)	LaGloria, Brooks and Jim Wells	LPG slug, gas	Planned	To start summer 1959		59 (pilot)
Pan American Petroleum Corp.	Three Bar, Andrews	LPG slug, gas	Active	Not reported	Not reported	Not reported
Parks Unit (Magnolia opr.)	Parks Pennsylvanian, Midland	LPG slug, gas	Inj. gas	June 1957	Good so far	8,205
Shamrock Oil & Gas Corp.	West Panhandle, Moore	LPG inj. as dual storage, oil recovery project	In production stage,	May 1952	Very good	600
Shamrock Oil & Gas Corp.	West Panhandle, Moore	LPG inj. as dual storage, oil recovery project	In production stage inj. complete	March 1955	Good	Not reported
Skelly Oil Co.	Panhandle, Hutchinson	LPG slug (butane), gas	Planned	Starting this year		160 (pilot)
Southern Minerals Corp.	Stratton, Nueces	Enriched gas drive	Inj. rich gas	July 1957	Not reported	Not reported
Sun Oil Co.	Millican Reef, Coke	LPG slug (propane) gas	Inj. dry gas	Summer 1956	Marginal	About 300 (pilot)
The Texas Co.	Tijerina-Canales-Blucher, Jim Wells	LPG slug, gas	Active	Fall 1957	Not yet apparent	Pilot
		WYOMING				
Continental Oil Co.	Meadow Creek, Johnson	LPG slug, gas changed to alternate slugs of LPG and water	Active	Spring 1957	Poor results with LPG slug; success of LPG-water	400
Mobil Oil Co.	Sand Creek Washakie	LPG slug, gas	Active	Not reported	Not reported	Not reported
Pan American Petroleum Corp.	Elk Basin, Park	Enriched gas drive	Active	Not reported	Not reported	Not reported

independent, quickly abandoned a butane-propane injection flood in Camp Hill field of Anderson County, Texas, when early increases in oil production failed to materialize. Buttram feels lack of response was due to a faulty oil-string cement job which he thinks sealed off the shallow Carizo-Wilcox pay zone in the center producing well of the five-spot pilot.

. . . **Petrocel Corp.,** a defunct subsidiary of Celanese Corp. of America, walked off from a combined LPG storage-oil recovery project in Killam field of Webb County, Texas, about 3 years ago. Petrocel was enthusiastic over early results but concluded finally that the "A" sand pay (Mirando) was not suited to either a miscible drive or storage.

. . . **Winthrop Corp.,** Fort Worth independent, dropped what it calls "a scientific success and economic failure" in June 1957.

This venture resembled the Petrocel operation in that propane was injected into the 400-ft. Olmost sand in Chicon Lake field of Medina County, Texas, as a joint LPG-storage- oil recovery project. The operation appeared to be working well. But a big hike in the price of LPG led Winthrop to halt propane injection. An attempt was made to use air to push the propane already injected, with poor results.

The company was impressed, however, by climbing oil production from the reservoir an the apparent good mechanics of the process. It is now negotiating toward a possible project over about 3,000 acres of stripper production in the Warren-Venango counties area of Pennsylvania. This time the venture would be aimed solely at hiking oil take from the sand.

4. Some See Success

Without doubt the most successful miscible drive to date is Atlantic's Block 31 Devonian high-pressure-gas project.

This operation, now in its tenth year, still has experienced no gas channeling or breakthrough.

Atlantic has injected roughly 91 billion cubic feet of gas through 15

input wells in the 6,000-acre project. It now is injecting about 42,000,000 cu. ft. daily at a wellhead pressure of more than 4,000 psi.

Injection volume was hiked from 37,000,000 cu. ft. daily to the present level in January to remedy a pressure lag in the south end of the unit area.

Atlantic has produced more than 42,000,000 bbl. of oil from the field. And the field is still young. It was discovered in 1945. Daily production is holding steady at the top allowable level of 15,400 bbl. a day.

The high-pressure-gas method in use in Block 31 is limited to reservoirs with high-b o t t o m-hole pressures—those with roughly 3,000 psi. or above. But Atlantic judges that it is applicable to more than 5% of domestic reserves. And this takes into account that the process seldom would be attractive economically in water-driven pools.

So far as is known, there have been no failures yet with the high-pressure-gas technique.

Only two others are known to be operating.

Shamrock happy . . . Shamrock Oil & Gas Corp. labels as highly successful the propane-butane injection project it has carried out under its Brumley lease in West Panhandle field, Texas, since May 1952. Injection was extended to Shamrock's adjoining Hight lease in March 1955.

Shamrock started the Brumley project as an LPG-storage project when it found itself without a market for large quantities of butane and propane in 1952.

The resulting big hike in oil recovery came as a pleasantly surprising accident. And the company wasted no time in taking advantage of it with continued injection.

Shamrock stopped LPG injection about 9 months ago because it had no more surplus product. The company, however, feels past injection is sufficient to complete the oil-recovery job in the shallow dolomite reservoir.

Since 1952 Shamrock has injected 2,685,710 bbl. of butane and propane. Up to the present, it has recovered 1,436,130 bbl. of this and has produced an estimated 40,000 bbl. more oil than it could have otherwise. Oil production still is running about 60 bbl. a day. And LPG is coming back at a rate of about 650-700 bbl. daily.

Shamrock thinks it eventually will recover at least 75 to 80% of the LPG injected.

Shamrock feels it could have gotten even better recovery results if it had been possible to operate the project as a closed system and cycle the LPG back. As it was the company injected LPG only intermittently and in varying quantities as surplus product became available.

5. Others Looking Good

It will, of course, take years of operation of some of the miscible drives before oil companies know for sure whether they will be successful and to what degree.

Many projects not already covered, however, are performing well so far. Some of them briefly, are:

. . . **Parks Unit** LPG slug drive in Parks Pennsylvanian field of West Texas operated by Magnolia Petroleum Co. Magnolia is analyzing results and believe they are good.

This project, the biggest of its type yet, takes in roughly 8,000 acres. Magnolia started the project in mid-1957, finished injecting 1,540,000 bbl. of propane in July 1958, and now is injecting dry gas.

Program initially was expected to hike oil take from the field by an added 30,000,000 to 40,000,000 bbl.

. . . **Columbus Unit** high-pressure-gas project operated by Cities Service Oil Co. in the 7-C zone of the Wilcox in Columbus field. The unit now is studying performance of a pilot prior to deciding on a possible extension over a much wider area of the 5,260-acre unit.

Results so far have been very good, with no breakthrough or evidence of channeling. Injection started in August 1957 in one well at rate of 5,000,000 cu. ft. daily and wellhead pressure of 4,500 psi.

. . . **Humble-operated programs** in the 20-B reservoir of Seeligson field in South Texas and the Goen and Cambrian pools of Bronte field in West Texas. All of these operations fall in the enriched-gas drive category.

Humble says all, as yet, are too young to evaluate. All were started in late 1956 and early 1957.

Core tests in the Seeligson project showed the reservoir swept completely clean of oil in the area of injection.

. . . **Shell Oil Co.'s tests** in Elk City field. Shell kicked off a pilot LPG slug drive in the P1 zone in the field in July 1957. It completed injecting 68,000 bbl. of propane in November 1957 and has been injecting gas since.

Oil-production response has been good though erratic from well to well due to nonconformities in the sand. There have been no notable breakthroughs.

Results have been good enough to lead Shell to start a similar operation in the field's deeper and much larger M zone. Company plans to inject around 850,000 bbl. of propane.

. . . **Ohio Oil Co.'s test** in South Coles Levee field in California. This is a unit operation with Ohio Oil, operator, joined by Standard Oil Co. of California, Richfield Oil Corp., Union Oil Co., Tidewater Oil Co., and Kern County Land Co.

Ohio has injected about 700,000 reservoir barrels of rich gas (mostly propane, plus some ethane and methane) into a small dark-oil reservoir in the unit area.

Ohio says oil-production response has been encouraging and the "absence of adverse effects even more encouraging." Too, the field gas-oil ratio has dropped without corresponding loss of oil-productive capacity.

Ohio souped up its injection gas with LPG in amounts over what has been felt by the industry generally to be sufficient so as to increase the odds against breakthrough.

. . . **Bisti Gallup test** in Bisti field of northwest New Mexico operated by Sunray Mid-Continent for itself and several other operators.

Sunray's 40-acre pilot has produced well over 200,000 bbl. of oil since 31,000 bbl. of LPG was injected starting in August 1957. Sunray is highly enthusiastic over results of the pilot so far and thinks field-wide application might net added 85,000,000 to 100,000,000 bbl. LPG slug is chased with dry gas.

. . . **Sun Oil Co.'s reef test** of the LPG slug method in Millican Reef field in West Texas. Sun engineers have recommended against extending the initial pilot to other parts of the field due to what it feels would be an abnormally high LPG requirement—perhaps 9 to 12% of hydrocarbon pore space as compared to 3% generally felt to be adequate normally. Despite considerable channeling and breakthrough, Sun feels that the Millican test was a success in that it more than paid for itself.

. . . **C-2 Block project** in Seminole City field started by Carter Oil Co. in May 1953. This was the first known test in which LPG was injected and chased with gas. Project is believed to be paying out very handily.

. . . **West Pampa test** operated by Cities Service in Panhandle field of Texas. Company injected an LPG slug (331,000 bbl.) starting July 1957 which represented 10% of hydrocarbon pore space in the reservoir.

Dry-gas injection started following the LPG. First oil increase was noted in December 1957. Good oil increases are typical. Company thinks more than 48,000 bbl. of oil output since is attributable to the miscible drive.

A Cities Service engineer says program benefits have been widespread, also that the process has proved it can improve oil take from a dolomite.

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ADVERTISEMENT of Tidewater Oil Co. which appeared in several West Coast papers. The publicity didn't please everyone . . .

New Gasoline Stirs Up a Storm

TIDEWATER Oil Co.'s new gasoline, announced with much fanfare as a "smog-fighting" fuel (OGJ, Mar. 16, p. 86), created a furor last week on the West Coast.

Competitors immediately branded the new gasoline as a "gimmick," and air-pollution officials rushed an analysis of the fuel to check on Tidewater's smog-reducing claims.

Said President R. L. Minckler of General Petroleum Corp. in a letter to employes: "It's a sales 'gimmick' that fools no one in the industry."

General Petroleum, he said, would lower vapor pressure this month "as we have done for 35 years." His real concern, Minckler added, "is that the fight against smog may be materially set back by this announcement.

Said Richfield Oil Corp.: "It would seem that Tidewater has decided to start its summer gasoline sales program a few weeks early."

S. Smith Griswold, Los Angeles County air pollution control officer, reported to the County Board of Supervisors that the encouraging aspect of the new fuel is in Tidewater's reduction of its olefin content.

Vapor pressure is lower, he said, but no lower than other premiums marketed from April through October every year.

Tidewater claimed the new fuel would fight smog by burning cleaner and cutting down on emissions, by a lower vapor pressure which would result in less evaporation, and by lowering olefin content.

Pollution officials have been in sharp disagreement with refiners over olefin content. They contend that olefins cause smog and are expected soon to ask for an order fixing limits on olefin content of gasolines. Refiners, however, claim olefins have no more bearing on smog than other light hydrocarbons if the percentage is kept below 40%.

U. S. Lists Names

in oil price-fixing case. No conspiracy date fixed.

A 53-PAGE document filed last week by the federal Government in its crude-oil and gasoline price-fixing case reads like a "who's who" in the 29 indicted major oil companies.

About 50 officials and employes of the various firms are named in a bill of particulars prepared by the Justice Department on order of U. S. District Judge Royce H. Savage in Tulsa.

The document discloses the Government has based its case on alleged conversations and telephone calls between the various officials, charging they discussed price increases before putting them into effect in January 1957.

In spelling out the indictment in more detail, the Government admitted it does not know the dates and duration of the alleged agreement by each defendant firm to boost prices.

The indictment charges the 29 companies conspired to hike prices of crude oil and gasoline following the Suez crisis.

The particulars . . . About 20 pages of the document lists dates on which the Government alleges two or more of the officials discussed a price increase.

The document listed more than 250 conversations during a 5-month period from September 1956 through January 1957, charging two or more of the officials were involved in the discussions. It stated some of the participants in the discussions were unidentified.

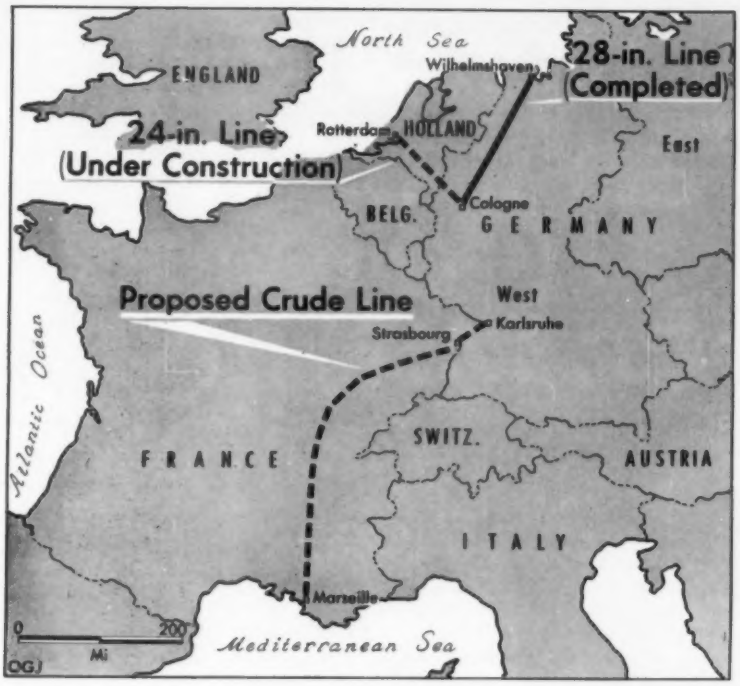
The bill stated: "Prior to the increases in the prices of crude oil and automotive gasoline made in January 1957, representatives of various defendants discussed directly with representatives of other defendants a general crude-oil price increase."

Also listed were public statements the Government alleges were made by three of the officials either "inviting" a price boost or indicating a company's "willingness" to raise prices.

Another section of the document contains names of oil-company officials who allegedly had telephone conversations regarding price increases.

The trial . . . No trial date has been set for the case, which was transferred to Tulsa from Virginia where the indictment was returned by a federal grand jury.

The trial probably will not get under way until late this summer. All but one of the indicted firms have agreed to waive a jury.



Big-Inch Crude Line Approved

. . . by French cabinet. New 30-in. system will open door to big refineries in eastern France and West Germany.

A PROPOSAL for a big-inch pipeline running northward through France has been endorsed by the French cabinet.

The 419-mile 30-in. system will run from the Mediterranean port of Lavera, near Marseille, to Strasbourg. A 40-mile extension will be built to Karlsruhe, West Germany.

The $100-million system is scheduled to open in 1963 with an initial capacity of 200,000 bbl. daily. Throughput will be increased to 400,000 bbl. daily in the second stage, and there may be further expansion later.

The project will probably be financed by some or all the 19 companies which formed Ste. du Pipeline Sud-European last year to study the program. Participants include Socony-Mobil, Caltex, Jersey Standard, Royal Dutch-Shell, British Petroleum, Cie. Francaise des Petroles, Petrofina, and local French and West German companies (OGJ, Aug. 11, 1958, p. 87).

The system will enable companies to build refineries in the consumption centers of eastern France and the Upper Rhine Valley for the first time. Omnium Francaise de Petroles plans to build a 60,000-bbl. plant near Chalon.

A Shell company has plans for a 60,000-bbl. plant at Strasbourg, where CFP will build a 70,000 to 80,000-bbl. plant. Jersey Standard may also build either in France or West Germany.

Other lines . . . The French system will lie along the route of a trans-European pipeline proposed after the Suez tie-up 3 years ago. This proposal called for a line from Marseille to Rotterdam or Wilhelmshaven.

While a Mediterranean-North Sea system was never undertaken, as such, fast progress has been made on individual sections. A 230-mile 28-in. line from Wilhelmshaven to the Ruhr is now going into service, and work has started on a 210-mile 24-in. system from Rotterdam to the same area.

Guatemalan Test Spudded

OHIO OIL Co. last week spudded its jungle wildcat on the Arruga Grande (Big Wrinkle) structure of interior Guatemala.

The spudding, on March 15, climaxed a 4,000,000-lb. airlift of the rig and supplies from Puerto Barrios to a 4,000-ft. runway hacked out of the jungle 6 miles from the drilling site.

The contractor, International Brown Drilling Co., has a 13,000-ft. rig on the hole. Drilling may go this deep unless oil is found or basement is hit at a shallower level. If drilling does go to 13,000 ft., an additional 2,000,000 lb. of supplies will be flown inland in what already is the biggest airlift in the oil industry's history (OGJ, Mar. 16, p. 81).

Ohio has as its partners in the operation Amerada Petroleum Corp., Continental Oil Co., and Union Oil Co. of California.

Red Gasoline Moves

through new products line linking Omsk and Siberia.

RUSSIA has completed its first products pipeline in Siberia.

Gasoline is moving eastward along a 465-mile line from a new refinery at Omsk to Novosibersk. The system is part of a pipelining program designed to ease supply problems caused by Soviet expansion in Siberia.

Omsk refinery is on the route of a 2,300-mile 28-in. pipeline that will carry crude from European Russia to Irkutsk, at Lake Baykal. This system will feed several plants along the way. The section from Omsk to Irkutsk will be completed next year, paralleling the new products line part of the way.

The crude line will then be extended to far eastern Siberia. Soviets say they expect to reach the industrial center of Khabarovsk, north of Vladivostok, in the early 1960's. Total length of the system will be more than 4,000 miles.

U. S. turndown . . . Russia is still shopping for big-diameter pipe in the U. S.

A trader seeking to export 12,227 tons of steel pipe to the Soviet Union has been turned down by the Department of Commerce for the third time.

This much pipe would make a section from 30 to 46 miles long, depending on how much of each size is involved. The pipe would be worth about $2.5 million. The sale has been prevented because of U. S. regulations controlling sale of strategic goods.

The Russians are already buying 24-in. pipe in West Germany.

Australia Attracts U. S. Firms

. . . as the hunt for oil picks up steam. Gulf and Murphy Corp. are the latest to apply for exploration permits.

TWO MORE American companies are joining the expanding Australian oil play.

Gulf Oil Corp., through a subsidiary, has applied for an exploration permit on 30,000 sq. miles in Northern Territory.

Murphy Corp., represented by Camelot Nominees Pty., has applied for a permit on 9,500 sq. miles in the Gulf of Papua, off southern New Guinea.

The area extends from Daru on the west toward Port Moresby to the east. The permit includes areas up to 30 miles offshore.

Extensive reconnaissance work in the gulf is planned by Murphy Corp. if the program is authorized. The grants are for one year and are extendable.

The Gulf application completes the roster of international oil majors which have entered the Australian search. Subsidiaries of Royal Dutch-Shell, Standard Oil Co. of California, and The Texas Co. each have two-sevenths interest in WAPET, an active exploration company in West Australia. A local firm holds the remaining interest.

Socony-Mobil and Standard Oil Co. (N. J.), joint owners of Standard-Vacuum, are stepping up their Australian operations through Stanvac's part interest in Frome-Broken Hill. British Petroleum also has an interest in Frome, and Stanvac and BP for years have been active in Australian New Guinea.

Independents active . . . Murphy Corp. is the latest of several American independents to move into Australia.

The most active play was sparked by Delhi-Taylor Corp., which acquired half interest in 267,000 sq. miles last year from Santos, Ltd. Interest in licenses covering a 110,000-sq.-mile portion of this concession was subdivided, with Santos, Ltd., Delhi-Australia, and Frome each taking a third (OGJ, Feb. 2, p. 77). This group is starting a $2-million wildcatting program. The first test is located at Innamincka.

The group reserves the right to drop out of the picture after the initial 2-year period. If it decides to continue, the agreement calls for additional expenditures over a 3-year period. This would hike the total exploration investment to about $10,700,000 by the end of 1963.

Plymouth Oil Co. has obtained a permit on Cape York Peninsula. Magellan Petroleum Corp., formerly Santiago Petroleum, has acquired a 22.4-million-acre block in the Great Artesian Basin and has 75% interest in a smaller block in the same area.

Barinas Flood Due

by Socony-Mobil if project gets Venezuelan approval.

A WATER-FLOODING program has been planned for the Barinas field of Socony-Mobil Oil Co. de Venezuela.

The company has asked the government for permission to drill four injection wells around the edges of San Silvestre reservoir. It hopes to start the water flood on a trial basis by the end of the year.

San Silvestre is producing about 20,000 bbl. daily from 23 wells. The field has a natural water drive, and the proposed program will determine whether water injections will help. Reservoir water from comparatively shallow sands will be used. The water is only slightly salty. Production of 28.1°-gravity crude is from 8,858 ft.

The flood was planned on the basis of a limited trial carried out 3 years ago. Water at that time was injected just outside the oil column. The formation took water, but information obtained was limited because the field was shut in at the time.

Crude from San Silvestre and from Sinclair Oil Corp.'s Sinco field moves from Barinas province to the Caribbean coast through a 211-mile 20-in. pipeline. San Silvestre was shut-in 6 weeks late last year for lack of a market. A survey of bottom-hole pressures was made at that time.

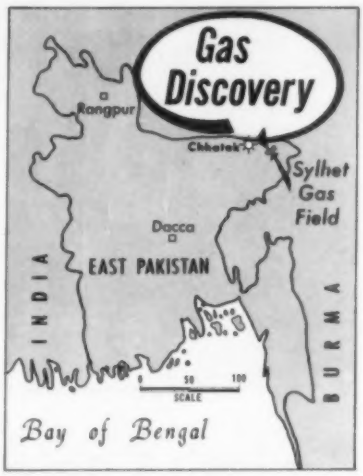
Sinclair, BP Form Company

THE EAST-WEST partnership of Sinclair Oil Corp. and British Petroleum Co. has started taking shape with the formation of a crude sales company.

The new jointly owned company is Sinclair & BP Sales, Inc. It will engage primarily in the sale of Middle East and Venezuelan crude oil in the Western Hemisphere.

The move implements one of three basic features of an agreement reached by Sinclair and the big British company in October. This partnership was designed to strengthen the position of both companies (OGJ, Nov. 3, p. 66). The two companies have a long-term crude supply deal that will cover Sinclair's domestic requirements for Middle East crude. The companies also have agreed to form a joint exploration and production company to operate primarily in Latin America.

Carl G. Drescher, Sinclair vice president, is president of the company. Robert D. Hill, operations manager of BP Trading, is senior vice president (see page 156).



East Pakistan Search Yields Another Gasser

ANOTHER GAS discovery has been made in East Pakistan.

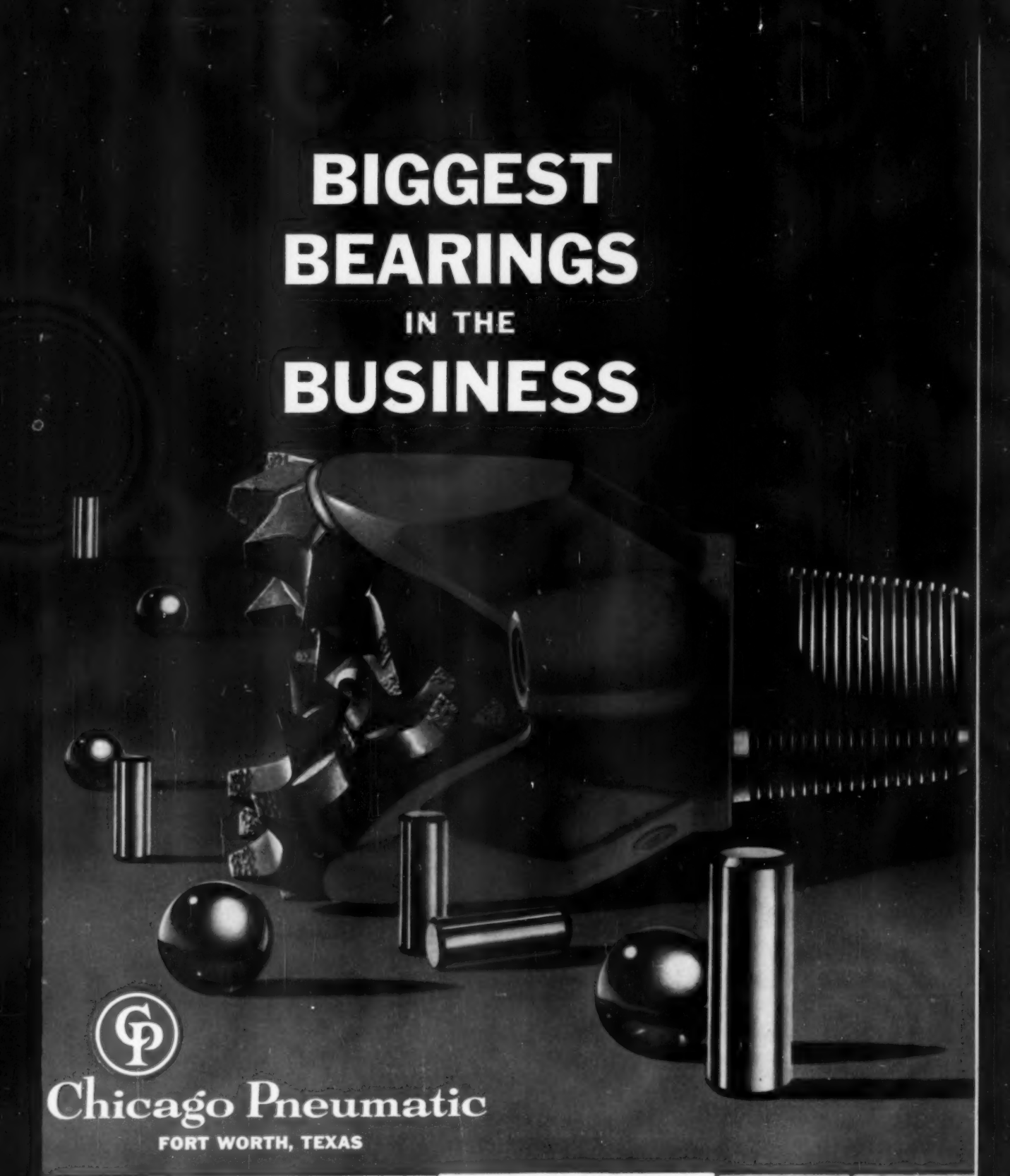
Production tests are under way in Chhatak 1, located 25 miles west of Sylhet gas field in northeast East Pakistan. Pakistan Petroleum, Ltd., made the find in a 7,000-ft. well completed in less than 29 days.

The Burmah Oil Co. subsidiary gave few details of the find but made it clear a discovery is definitely indicated. The successful well is part of Pakistan Petroleum's fast-moving exploration program. After the Chhatak completion, the entire drilling crew was airlifted 1,700 miles to West Pakistan for another wildcat. This well has been started at Kandhkot, south of Sui gas field.

The initial East Pakistan find at Sylhet was made 4 years ago. Some development work has been carried on, but the field is still shut in.

Sui field is in commercial production, but offtake is far below its potential. Sixteen-inch pipelines from the field extend south to Karachi and northeast to Multan.

BIGGEST BEARINGS IN THE BUSINESS



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In Ontario, Canada, near the northern shore of Lake Huron, Hudson Engineering (Canada) Limited has recently completed the construction of a major uranium ore mining and milling project for Stanrock Uranium Mines, Limited. Located in the Blind River area, which contains the free world's largest reserve of uranium, the design quantity of 3,000 tons per day is being mined and milled, uranium oxide being the end product.

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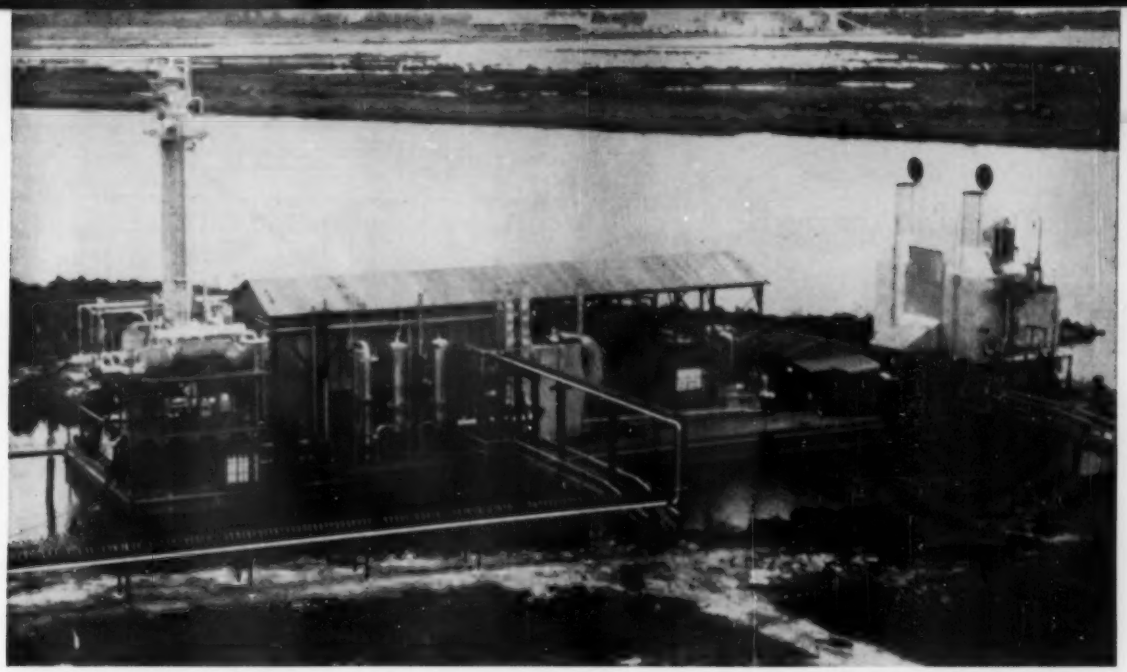


NATURAL-GAS LIQUEFACTION plant has been operated since 1956 by Constock International Methane which plans large-volume movements overseas. Fig. 1.

LIQUID METHANE

. . . a cheaper means of

PEAK SHAVING?

Design data, investment, and operating costs are developed from fully engineered, large-scale plant designs prepared by J. F. Pritchard & Co. for Constock International Methane, Ltd. These costs are current, firm investment figures subject to a 5% maximum contingency factor. In using these costs, the annual average 7% increase experienced for this class of facilities must be allowed if the costs are used for future proposed investments.

BY A. RUSSELL YOUNG
Vice president J. F. Pritchard & Co., and Constock - Pritchard Liquefaction Corp.*

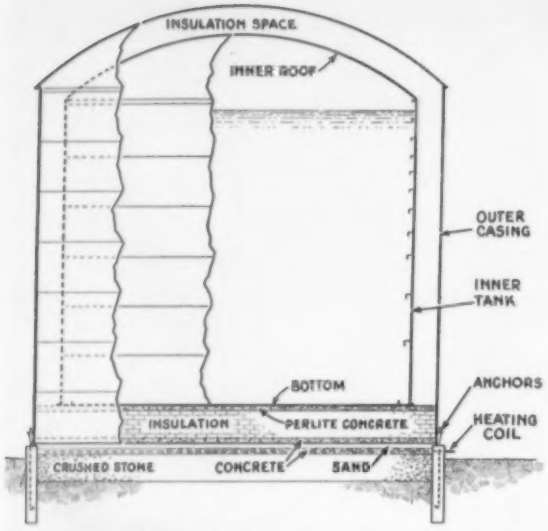
CURRENT PROGRESS and development in gas liquefaction and storage have been carried on very rapidly in the past few years by Constock International Methane, Ltd. This is a joint venture of Continental Oil Co. and Union Stock Yard & Transit Co. of Chicago. Their plans go far beyond peak shaving and their research, design, and test operations are scaled to the large - volume movement of liquid methane to overseas fuel-hungry markets. The articles in various publications indicate the scale of supplying a gas load, even partially, to a city like London.

In 1954, the Union Stock Yards group started construction of a 6 to 8-M.M.c.f. liquefaction unit. Since 1956, this unit (Fig. 1) has been in operation by Constock, obtaining valuable data. This unit is now supplying liquid methane for the cargo filling of the Methane Pioneer, a ship jointly owned by the British Gas Council and Constock International Methane, Ltd.

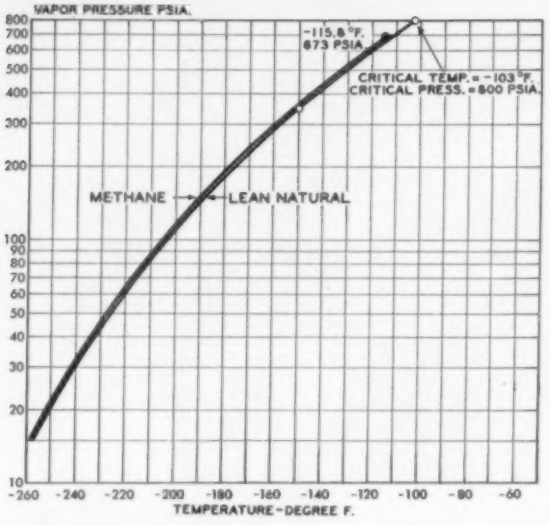
Operation of the Constock liquefaction plant is proving out economical designs for future liquefaction plants. More important yet will be the data from the Methane Pioneer which has landed a cargo of liquid methane. Her performance will be invaluable in establishing the practicality of large-volume liquid methane.

At both Constock Lake Charles, La., terminal and the British Gas Council plant on the Thames River near London, 100 M.M.c.f. of liquefied-methane storage has just been installed. These are flat - bottomed,

*Constock-Pritchard Liquefaction Corp., a combination of Constock, (Continental Oil Co. and Union Stock Yards & Transit Co.) and J. F. Pritchard & Co. Constock International Methane, Ltd., is an operating company for the supply of natural gas to overseas markets utilizing liquefied natural gas for ship transportation and storage.



CRYOGENIC STORAGE tank for liquids at —150° to —300° F. provides liquid-methane storage at Lake Charles, La., and London. Fig. 2.



TEMPERATURE-VS.-PRESSURE curve shows methane or natural gas is a liquid at —259° F. and atmospheric pressure. Fig. 3.

dome-roofed, double-walled tanks operating at —259° F. and atmospheric pressure. Inner tanks are aluminum and outer tanks carbon steel. The Lake Charles tank makes the eighth such tank Chicago Bridge & Iron Co. has built since 1954, the majority of which are on liquid oxygen at —300° F. storage duties (Fig. 2).

Liquefaction Facilities

There are numerous processes or combinations by which gases may be liquefied. Extensive studies have been made over the past 3 years evaluating different ones. In all cycles the basic principle is the same. The gas is taken to some economical pressure above 400 psia. and cooled to below its liquefaction temperature and thence flashed in successive stages to the atmospheric —259° F. storage. Gas liquefaction, temperature vs. pressure curve (Fig. 3) shows this physical property, for an average lean natural gas and pure methane. For practical purposes when we speak of liquefied natural gas or methane we mean the same.

As evidenced by a temperature-pressure diagram, natural gas above —103° F. and 800 psia. corresponding vapor pressure can only be a gas.

Pure methane above —115° F. and 673 psia. can only be a gas. At temperatures and pressures below these, they can exist as liquid. At —259° F. methane or natural gas is a liquid at atmospheric pressure.

By cooling the gas to various temperatures at pressures corresponding within this range, the gas can be liquefied.

Comparative temperatures of methane against other gases that might be used as refrigerants are as follows:

Gas—	Temp. at atmo. press. (° F.)	Temp. at critical press.
Methane	—258.5	—116.5° @ 673 psia.
Ethylene	—154.7	49.8° @ 742 psia.
Ethane	—128.2	90.1° @ 708 psia.
Propylene	— 53.7	197.4° @ 667 psia.
Propane	— 43.8	206.3° @ 617 psia.
Isobutane	+ 10.0	275.0° @ 529 psia.
Butane	+ 31.1	305.6° @ 551 psia.

From extensive investigation of different liquefaction processes it has been concluded that either the so-called expander cycle (Fig. 4) or the cascade cycle (Fig. 5) are the two most preferred.

The expander cycle is the simpler of the two. For the conditions in this study, 140-psia. natural gas is compressed to 1,500 psia. in this case, taken through progressive gas to gas heat exchange against approximately twice its volume of cold recycle natural gas, which cools it below its liquefaction temperature and the pressure reduced by stages to the storage pressure.

The recycle gas is recompressed to 1,500 psia., cooled and bled through an expander engine where it chills to approximately —190° F. before heat exchanging against the liquefying stream. Basically this is a straight methane-refrigeration cycle and on 140-psia. natural gas requires approximately 700 b.hp. per M.M.c.f. a day liquefied. This has the advantage of simplicity and although higher brake horsepower requirements than the cascade cycle, it is more economical in small-sized plants.

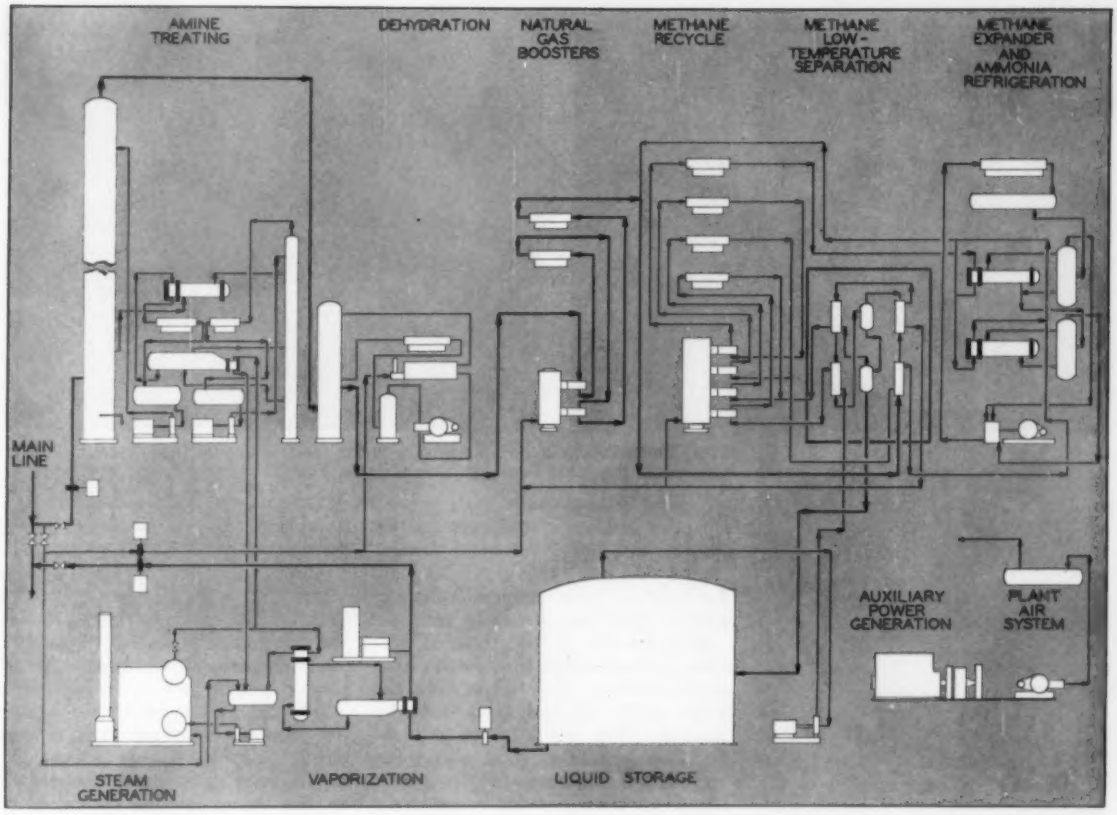
The cascade cycle is almost the same as the expander "methane"-refrigeration cycle except that in larger plants other refrigerants are substituted, such as propane down to —40° F. or ethane down to —120°, thus saving brake horsepower in the higher heat-level range with final subcooling by methane heat exchange and recycle as it is flashed to the storage pressure. In this system the expander is generally not used, and the system requires approximately 540 b.hp. per M.M.c.f. a day liquefied. The saving in brake horsepower offsets the addition of the supplementing separate refrigeration system in the larger plants.

Expander-Cycle Liquefaction Facilities

Metering . . . Facilities are provided to measure incoming and outgoing volumes and B.t.u. values. Plant fuel use is metered and regulated separately within the plant.

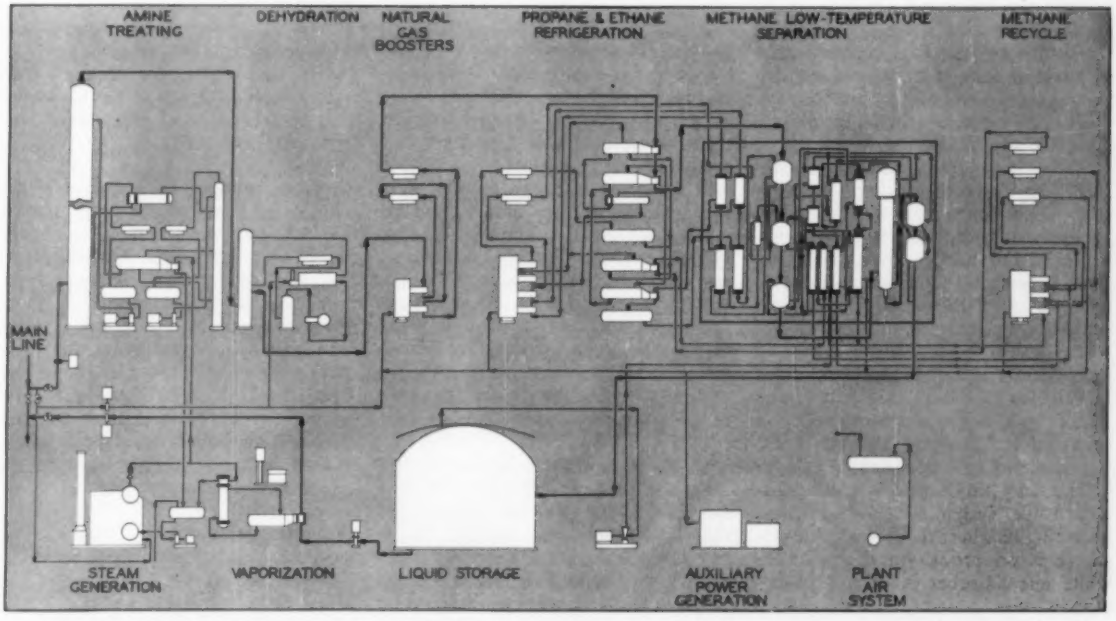
Amine treating . . . Process gas is scrubbed at 140 psig. with a 15% by weight aqueous solution of MEA (monoethanolamine) to remove carbon dioxide or hydrogen sulfide which would plug up cold equipment in the liquefaction unit.

The amine-contacting system consists of a tray contactor for gas-liquid contact and a still for regenerating the MEA. Gas charged to the unit enters the bottom of the contactor and rises countercurrent to the descending amine solution which reacts with the acid gases in the process gas stream to form compounds which may be bro-

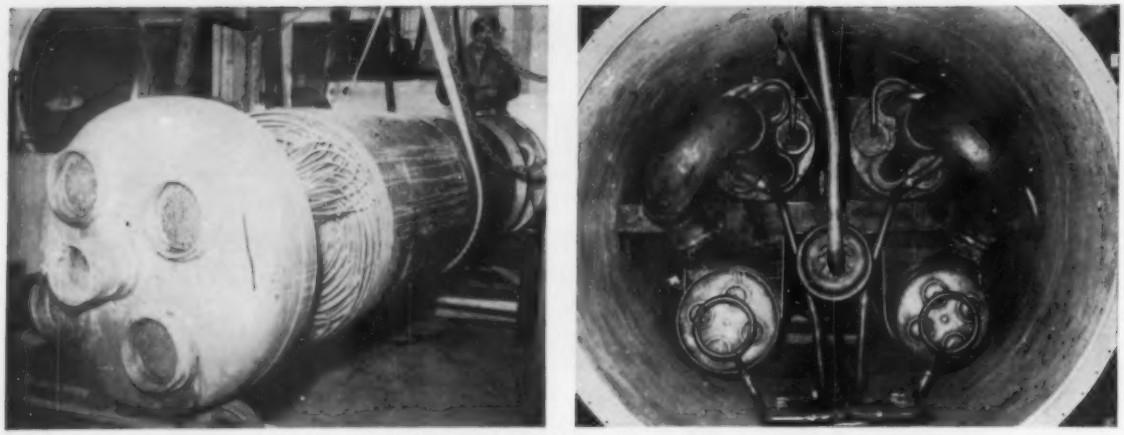


EXPANDER CYCLE is simple straight methane-refrigeration cycle, is more economical in small plants. Fig. 4.

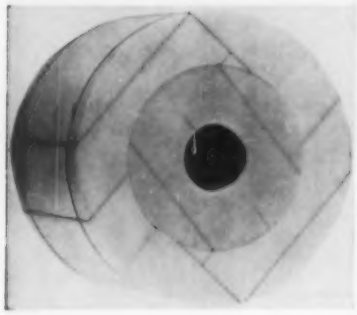
"Either the expander cycle or the cascade type are the two most preferred."



CASCADE CYCLE is similar but in large plants refrigerants such as propane or ethane are substituted. Fig. 5.



COLD EXCHANGERS, nitrogen-flash systems, and low-level flash systems are incorporated into cold box-type installations. Fig. 6.



ken down by heat. It is this property which permits the amine solution to be regenerated in a separate still tower for reuse.

The rich amine containing absorbed acid gases is heat-exchanged with lean regenerated amine from the still reboiler before being charged to the still. As the hot liquid descends through the tower trays, it is contacted with ascending steam generated in the still reboiler. The heat-sensitive compounds formed by the reaction of acid gases with MEA are broken down and the acid gases, plus steam, leave the top of the still.

The steam is condensed and returned to the still as reflux, while the acid gases are vented to flare. Regenerated amine from the still reboiler is heat-exchanged with cold rich amine returning from the contactor, cooled, and pumped back over the contactor to complete the cycle.

Dehydration unit . . . The process gas leaving the amine-treating unit is saturated with water and must be dried to avoid ice plugging of subsequent low-temperature equipment.

The dehydration unit is a solid-desiccant-type design of two adsorbers operating on alternate cycles. One adsorber is on process-gas-drying cycle while one adsorber is being regenerated.

The inlet wet process gas enters a separator section at the base of the adsorber and passes through a central uptake riser and flows down through the desiccant beds and leaves the adsorber above the separator sections.

Regeneration of spent beds of desiccant is accomplished by means of a small stream of high-temperature gas which strips adsorbed water from the desiccant. This gas is heated in a reactivation gas heater and after passing through the desiccant is cooled in the reactivation gas cooler-condenser in which the water removed from the desiccant is condensed and removed from the system in the reactivation gas separator. The reactivation gas pressure is raised by the booster compressor sufficiently to overcome the pressure drop in the system before being heated once more and thus completing the cycle.

Process-gas liquefaction unit . . . Two stages of gas compression are provided to elevate the inlet 140-psia. process gas to 1,500 psia. At this pressure, the process gas is liquefied by successive exchange against low-temperature 150-psia. flash gas, 50-psia. flash gas, boiloff gas from storage, and expanded recycle gas. To effect nitrogen removal the pressure of the process stream is let down to 150 psia. where the nitrogen is stripped from the liquid and sent to plant fuel use along with some methane. After nitrogen removal, the process stream is further subcooled by pressure let down at a 50-psia. flash and to storage pressure.

A methane recycle system is provided to recompress the recycling gases to 1,500 psia. for reentry into the liquefaction unit. Boiloff vapors from heat leak into the storage facilities are compressed in the first stage, 50-psia. flash vapors are introduced into the recycle stream at the second stage, and 150-psia. expanded gas at the third stage.

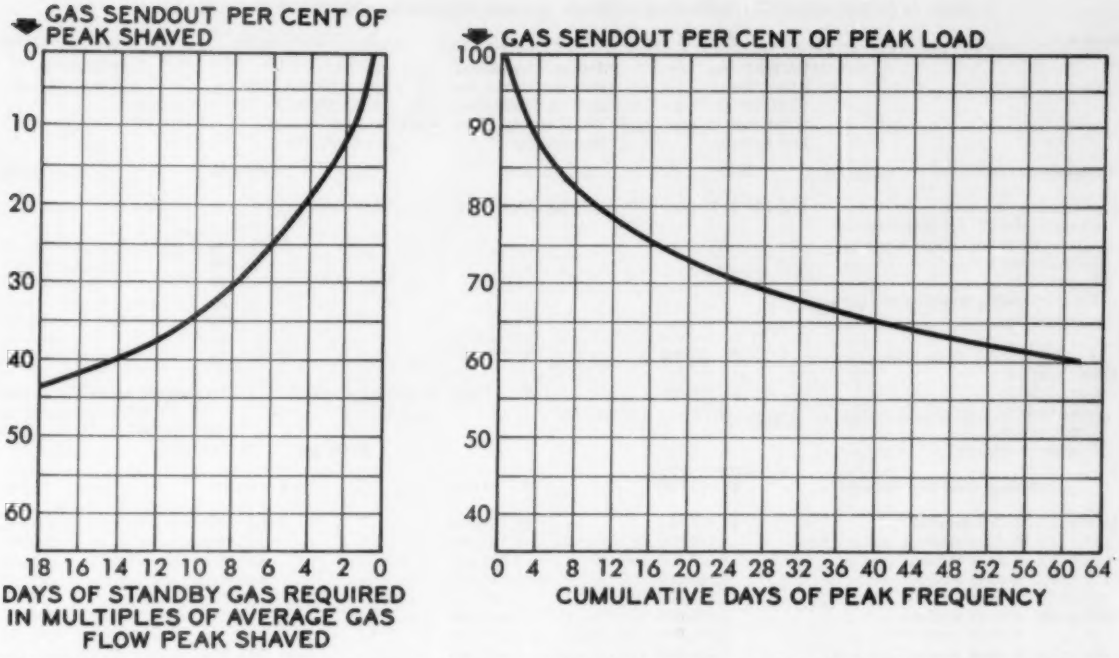
This total recycle stream is further compressed in the fourth stage, chilled against an ammonia-refrigeration unit, and the greater portion of this 1,500-psia. stream passes through an expander engine where it drops to −190° F. and is exchanged against the process-gas stream. The remainder of the chilled recycle gases returns to the main gas-stream direct-contact cooling before entering the exchanger equipment. For simplicity on intermittent operation, conventional aerial-type gas coolers are used as interstage and aftercoolers to remove high-level heat where required.

Power recovered from the expander engine is used to drive the ammonia - refrigeration compressors. The ammonia equipment consists of two stages of chillers and compressors with aerial-type condenser.

The cold exchangers, nitrogen-flash systems, and low-level flash systems will be incorporated into a cold box-type installation (Fig. 6).

Methane storage . . . Storage facilities consist of tanks of flat-bottom, double-wall, umbrella-roof construction with 3-ft. insulation between inner tank and outer wall. Tank foundations are supported on piling above grade to obtain maximum stability and to provide ventilation for dissipating heat loss through the tank bottom. Tanks have a dike system providing for 110% of liquid contents. Normal gas boiloff from heat leak is picked up and boosted back to the process liquefaction system.

Vaporization unit . . . Methane vaporization is accomplished by utilizing propane as the heat-transfer medium from 50-psig. steam in a closed thermal siphon system to eliminate



GAS SENDOUT figures are based on average of seven utilities, showing per cent of peak shaved and per cent of peak load. Fig. 7.

condensate-freezing problems. Low-temperature service pumps are provided to charge the vaporizers at pipeline pressure.

Auxiliaries . . . Normal station auxiliaries are required to provide for starting and instrument air, lubricating-oil storage, boiler-makeup-water treating, etc.

Primary electric-power source is purchased with an auxiliary engine-driven generator of minimum size to allow plant operation on static shut-in service.

Boilers for vaporization are package type with dual-fuel firing equipment.

A well pump system and a 1,500-bbl. water-storage tank are provided for plant requirements.

Cascade-Cycle Liquefaction Facilities

General facilities for metering, gas treating, storage, vaporization, and auxiliaries are the same as required for the expander-cycle plant previously described.

The process-gas liquefaction facilities consist of initial gas-compression stages to approximately 700 psia. where the gas enters the refrigeration system.

There are two stages of propane and ethane refrigeration and three stages of methane refrigeration. Low-level propane condenses ethane, and low-level ethane removes the equivalent of latent heat from methane. The two levels of propane refrigeration cool and partially condense the process gas at −29° F. The two stages of ethane refrigeration totally condense the 700-psia. process stream at approximately −110° F. and subcool the liquid.

After the first stage of methane refrigeration, nitrogen and some methane are removed from the stream and sent to plant fuel. After nitrogen removal, the process stream is further subcooled by two stages of methane refrigeration and sent to storage. Boiloff vapors from the storage facilities are returned by gas booster through heat exchange to the methane-refrigeration cycle. As in the expander cycle, cold equipment and nitrogen stripper are incorporated into cold box-type equipment.

Economics of Peak-Load Shaving

The economics in peak shaving are in how much additional revenue can be made in increased firm sales rather than how much the peak sendout costs you. Peak gas can cost many times the sales value and have little effect on the net return since it is produced only a few days a year.

As storage is the major portion of the peak-shaving plant investment, a study of average and worst-winter system peaks and frequencies is necessary. The chart (Fig. 7) shows the gas sent out as per cent of peak load representing an average of seven utilities. The right-hand curve shows cumulative days of peak frequency. The left-

TABLE 1—INVESTMENT COSTS—LIQUEFIED NATURAL-GAS PEAK SHAVING PLANT

	Expander cycle	Approx. increment cost	Cascade cycle
Liquefaction capacity	2,000,000 S.c.f.d. 140-psi. gas 1,700 b.hp.	$250,000/M.M.s.c.f.d.	13,000,000 S.c.f.d. 140-psi. gas 8,500 b.hp.
Vaporization delivery capacity	30,000,000 S.c.f.d. 250-400 psi.	$7,000/M.M.s.c.f.d.	150,000,000 S.c.f.d. 200-400 psi.
Storage	200,000,000 S.c.f.	$650,000/100 M.M.s.c.f. gas storage	1,600,000,000 S.c.f.
Auxiliary and service facilities	Included	Included	Included
Total	$4,000,000	.....	$16,000,000

TABLE 2—COMPARATIVE ECONOMICS PEAK LOAD SHAVING — 50,000,000 S.C.F.D. PEAK

Source	Pipeline contracts capacity		Propane air	Liquefied natural
	Current gas contracts based on $200,000/M.M. average cost of pipeline systems	Future increment increases based on current $600,000/M.M. cost of pipeline systems	450 M.M. storage	2 M.M. liq.-300 M.M. storage
Investment	None	None	$3,450,000	$5,400,000
Fixed cost or demand	$22/M. $1,100,000	$75/M. $3,750,000	.....	.....
Charges of 12% for depreciation, interest, taxes, insurance, etc.	.....	.....	$ 414,000	$ 648,000
Maintenance	.....	.....	18,000	30,000
Supervision	.....	.....	15,000	20,000
Fixed operating and tank refrigeration costs	.....	.....	50,000	80,000
Total fixed costs/year	$1,100,000	$3,750,000	$ 497,000	$ 778,000
Direct cost of:				
Gas at $0.30	$ 15,000	$ 15,000	(1,350 B.t.u. sales) 13,300 (loss)	$0.30/M. $ 15,000
Liquefaction	.....	.....		0.25/M. 12,500
Vaporization	.....	.....	1,750	0.025/M. 1,250
Propane—summer	.....	.....	$0.06/gal. 33,300	
Operating cost/day sendout	$ 15,000	$ 15,000	$ 48,350	$ 28,750
Cost gas— 1 day sendout	$1,115,000	$3,765,000	$ 545,350	$ 806,750
2 days sendout	1,130,000	3,780,000	593,700	835,500
3 days sendout	1,145,000	3,795,000	642,050	864,250
4 days sendout	1,160,000	3,810,000	690,400	893,000
5 days sendout	1,175,000	3,825,000	738,750	921,750
25% peak 6 days sendout	1,190,000	3,840,000	787,100	950,500
7 days sendout	1,205,000	3,855,000	835,450	979,250
8 days sendout	1,220,000	3,870,000	883,800	1,008,000
9 days sendout	1,235,000	3,885,000	(Winter purch. 932,150	1,036,750
10 days sendout	1,250,000	3,900,000	at $0.10/gal.) 1,002,700	1,065,500
11 days sendout	1,265,000	3,915,000	1,073,250	1,094,250
35% peak 12 days sendout	1,280,000	3,930,000	1,143,800	1,123,000
Maximum yearly capacity 13 days, 650 M.M.s.c.f.	$2/M. $1,295,000	$6.08/M. $3,945,000	$1.87/M. $1,214,350	$1.78/M. $1,151,750

hand curve is the important one to peak shaving. It shows the total volume of gas required to shave a peak expressed in terms of days standby in multiples of peak-volume shaving capacity.

If 40% of peak demand is shaved, the total volume would be the 40% quantity times the 14 days average time. This is an important factor that each utility must review against its actual load and peak experience.

Investment costs . . . The two liquefaction cycles described have been fully investigated as to relative costs. For the larger-capacity plants the cascade cycle is more economical, while the expander cycle is applicable for the smaller-capacity plants.

A tabulation of plant costs (Table 1), exclusive of land and company overhead, is shown for two plants with an approximate increment cost to adjust plant costs up or down for different rates of liquefaction, vaporization delivery capacity, and storage facilities.

For adjustments in these capacities the increment cost is added to or subtracted from the closer base plant as follows:

Base plant:	
2 M.M.s.c.f.d. liquefaction	$4,000,000
30 M.M.s.c.f.d. vaporization	
200 M.M.s.c.f.d. storage	
Convert to:	
2 M.M.s.c.f.d. liquefaction	no change
50 M.M.s.c.f.d. vaporization	
20 M.M.s.c.f.d. at $7,000	140,000
300 M.M.s.c.f.d. storage	
100 M.M.s.c.f.d. at $650,000	650,000
	$4,790,000

This method of adjusting costs within these size ranges will be more accurate than working from unit prices based on total cost per M.M.s.c.f.d. since the cost of general facilities, gas treating, and auxiliaries varies only slightly.

From inspection of any system's daily-load curve, it can be readily seen that the frequency of peaks above our average load occur a very small per cent of the total year. As the chart (Fig. 7) averaging gas sendout from seven utilities shows, gas requirement in the top 40% peak-demand bracket would occur fewer than 60 days out of the year, and the total volume of gas required in these days would only be equivalent to the 40% peak for 14 days. This means the fixed costs of a peak-shaving plant or the demand charge, in the case of contract gas to supply these peaks, will be the major part of the yearly cost.

In reviewing figures for eastern gas it is indicated that an average yearly demand charge of $22 per M.s.c.f. and $0.30 per M.s.c.f. commodity rates are in effect. Ofttimes the commodity rate has some fixed operational charges included so it will vary among different companies slightly, but basically the demand charge represents the fixed charge of the investment of the transmission pipeline.

If this $22 per M.s.c.f. per year demand is considered as a fixed charge corresponding to 12% of their investment, it would indicate the value of pipeline-system facilities currently supplying gas was approximately $185,000 per M.M.s.c.f. Most of these systems were built 10 years ago and their normal depreciation probably exceeds any extra cost of later added facility investment. They are also expanded to nearly ultimate capacity, say 600 M.M.s.c.f.d. for 26-in. lines, and operate at high constant-load factors.

Comparison of costs of present new lines being built or proposed indicates a 400-M.M.s.c.f.d. new line to the New York area from any reasonable gas reserve area in 1960 would cost $600,000 per M.M.s.c.f.

AGA news letter on FPC applications indicates Transcontinental's recently approved added facilities, plus proposed additions to be filed, show over $200,000,000 required investment to deliver about 320 M.M.s.c.f. of gas to the New York area. Trunkline Gas has asked $81,500,000 to deliver 100 M.M.s.c.f.d. to Michigan.

TABLE 3—COMPARATIVE ECONOMICS PEAK LOAD SHAVING—150,000,000 S.C.F.D. PEAK

Source	Pipeline contracts capacity		Propane air	Liquefied natural
	Current gas contracts based on $200,000/M.M. average cost of pipeline systems	Future increment increases based on current $600,000/M.M. cost of pipeline systems	1,800 M.M. storage (2 plants)	13 M. liq.-1,600 M.M. storage
Investment	None	None	$10,500,000	$17,300,000
Fixed cost or demand	$22/M. $ 3,300,000	$75/M. $11,250,000		
Charges of 12% for depreciation, interest, taxes, insurance, etc.			$ 1,260,000	$ 2,076,000
Maintenance			50,000	80,000
Supervision			20,000	20,000
Fixed operating and tank refrigeration costs			110,000	130,000
Total fixed costs/year	$ 3,300,000	$11,250,000	$ 1,440,000	$ 2,306,000
Direct cost of:				
Gas at $0.30	$ 45,000	$ 45,000	(1,350 B.t.u. sales) 40,000 (loss)	$0.30/M. 45,000
Liquefaction				0.08/M. 12,000
Vaporization			5,000	0.01/M. 1,700
Propane—summer			$0.06/gal. 100,000	
Operating cost/day sendout	$ 45,000	$ 45,000	$ 145,000	$ 58,700
Cost gas— 1 day sendout	$ 3,345,000	$11,295,000	$ 1,585,000	$ 2,364,700
2 days sendout	3,390,000	11,340,000	1,730,000	2,423,400
3 days sendout	3,435,000	11,385,000	1,875,000	2,482,100
4 days sendout	3,480,000	11,430,000	2,020,000	2,540,800
5 days sendout	3,525,000	11,475,000	2,165,000	2,599,500
25% peak 6 days sendout	3,570,000	11,520,000	2,310,000	2,658,200
7 days sendout	3,615,000	11,565,000	2,455,000	2,716,900
8 days sendout	3,660,000	11,610,000	2,600,000	2,775,600
9 days sendout	3,705,000	11,655,000	2,745,000	2,834,300
10 days sendout	3,750,000	11,700,000	2,890,000	2,893,000
11 days sendout	3,795,000	11,745,000	3,035,000	2,951,700
35% peak 12 days sendout	3,840,000	11,790,000	3,180,000	3,010,400
13 days sendout	3,885,000	11,835,000 (Winter purch.	3,391,650	3,069,100
14 days sendout	3,930,000	11,880,000 at $0.10/gal.)	3,558,300	3,127,800
15 days sendout	3,975,000	11,925,000	3,769,950	3,186,500
16 days sendout	4,020,000	11,970,000	3,981,600	3,245,200
40% peak 17 days sendout	4,065,000	12,015,000	4,193,250	3,303,900
18 days sendout	4,110,000	12,060,000	4,404,900	3,362,600
Maximum yearly capacity 27 days, 4,000 M.M.s.c.f.	$1.12 M. $ 4,515,000	$3.13/M. $12,465,000	$1.58/M. $ 6,309,750	$0.97/M. $ 890,900

TABLE 4—ECONOMICS OF PEAK LOAD SHAVING—25 to 30% OF PEAK = 50,000,000 S.C.F.D. AT 250-400 PSI.

(Total annual gas peak shaved = 400,000,000 S.c.f.)

Source of gas—		Liquefaction and storage	Pipeline contracts	
		2 M.M.s.c.f.d. into 300 M.M.c.f. storage	Current gas contracts based on $200,000/M.M. average cost of pipeline systems.	Future increment increases based on current $600,000/M.M. cost of pipeline systems
Investment		$5,400,000	None	None
Fixed cost or demand:				
Charges of 12% for depreciation, interest, taxes, insurance, etc.		$ 648,000	$22/M. = $1,100,000	$75/M. = $3,750,000
Maintenance		30,000		
Supervision		20,000		
Fixed operating and tank refrigeration costs (minimum crew)		80,000		
Total fixed costs/year		$ 778,000	$1,100,000	$3,750,000
Gas liquefaction—400 M.M.		100,000		
Gas vaporization—400 M.M.		10,000		
Commodity cost gas—400 M.M. at $0.30		120,000	*120,000	*120,000
Total cost peak load/year		$1,008,000	$1,220,000	$3,870,000
Basis 30% load factor added firm yearly gas salable from 50 M.M. peak shaved = 5,500 M.M.c.f./year within demand base				
Additional commodity gas purchased—5,100 M.M. at $0.30		$1,530,000	$1,530,000	$1,530,000
Total cost 5,500 M.M.c.f. sales	$0.46/M. =	$2,538,000	$0.50/M. = $2,750,000	$0.98/M. = $5,400,000
Estimated value less added distribution	$0.80	4,400,000	4,400,000	4,400,000
Added gross income		$1,862,000	$1,650,000	loss $1,000,000

*Based on commodity price today low enough to sell remainder as interruptible gas.

TABLE 5—ECONOMICS OF PEAK LOAD SHAVING—35 TO 40% OF PEAK = 150,000,000 S.C.F.D. AT 250-400 PSI.

(Total annual gas peak shaved = 2,400,000,000 S.c.f.)

Source of gas—	Liquefaction and storage	Pipeline contracts capacity	
	13 M.M.s.c.f.d. into 1,600 M.M.c.f. storage	Current gas contracts based on $200,000/M.M. average cost of pipeline systems	Future increment increases based on current $600,000/M.M. cost of pipeline systems
Investment	$17,300,000	None	None
Fixed costs or demand:			
Charges of 12% for depreciation, interest, taxes, insurance, etc.	2,076,000	$22/M. = $ 3,300,000	$75/M. = $11,250,000
Maintenance	80,000		
Supervision	20,000		
Fixed operating and refrigeration costs (minimum crew)	130,000		
Total fixed costs/year	$ 2,306,000	$ 3,300,000	$11,250,000
Gas liquefaction—2,400 M.M.c.f.	190,000		
Gas vaporization—2,400 M.M.c.f.	35,000		
Commodity cost gas—2,400 M.M. at $0.30	720,000	*720,000	*720,000
Total cost peak load gas/year	$ 3,251,000	$ 4,020,000	$11,970,000
Basis 30% load factor added firm yearly gas salable from 150 M.M. peak shaved = 16,500 M.M.c.f./year within demand base			
Additional commodity gas purchased—14,100 M.M. at $0.30	$ 4,230,000	$ 4,230,000	$ 4,230,000
Total cost 16,500 M.M. sales	$0.45/M. = $ 7,481,000	$0.50/M. = $ 8,250,000	$0.98/M. = $16,200,000
Estimated value less added distribution at $0.80	$13,200,000	$13,200,000	$13,200,000
Added gross income	$ 5,719,000	$ 4,950,000	loss $ 3,000,000

*Based on commodity price being low enough to sell the remainder as interruptible gas.

Small incremental additional capacity may be obtained for some less than this by looping or adding compressor horsepower, but no big volume can be obtained for much less than the $600,000 per M.M.s.c.f.d. delivery.

It may be allocated into higher commodity rates spread over the total gas volumes so that it doesn't look like much but the incremental added investment cost is there and it must be realized that the actual fixed facilities will demand approximately $75 per M.s.c.f.d. capacity no matter how it is charged off.

To avoid the controversial question of what your demand charge will be, economic comparisons have been set up for both $22 per M.s.c.f. and $75 per M.s.c.f. permitting rapid correlation between the two.

Liquefied natural-gas storage and peak shaving is not for the real small demand. Propane has always been the answer for anything under say 20 M.M.s.c.f.d. delivery. A minimum liquefaction plant will cost $3,000,000. For this reason, economics have been set up on 50 M.M.s.c.f.d. and 150-M.M.s.c.f.d. plants.

The Comparative Economic Peak Load Shaving Tables 2 and 3 show these two capacity plants compared against peak shaving with $22 per M.s.c.f. Natural-Gas Demand, $75 per M.s.c.f. Natural-Gas Demand and Propane Air. Thirty-five to forty per cent of the peaks are assumed to be shaved requiring 12 to 14 days. The propane-air plants have utilized refrigerated 40,000-bbl. storage tanks to obtain the minimum investment.

The maximum yearly-capacity cut-off points represent the maximum sendout gas that could be made for the daily liquefaction capacity of the plant. The gas for liquefaction is based on commodity-rate price only, as there is ample capacity under present load contract normally for summer fill. The price of propane has been taken as $0.06 per gallon based on summer fill of tanks and $0.10 per gallon for the added winter purchases. This propane cost will vary greatly but it is on the lower side in this comparison.

Note that liquefied methane in both cases is less costly than even present low $22 per M.c.f. demand charges.

Added Income from Peak Shaving

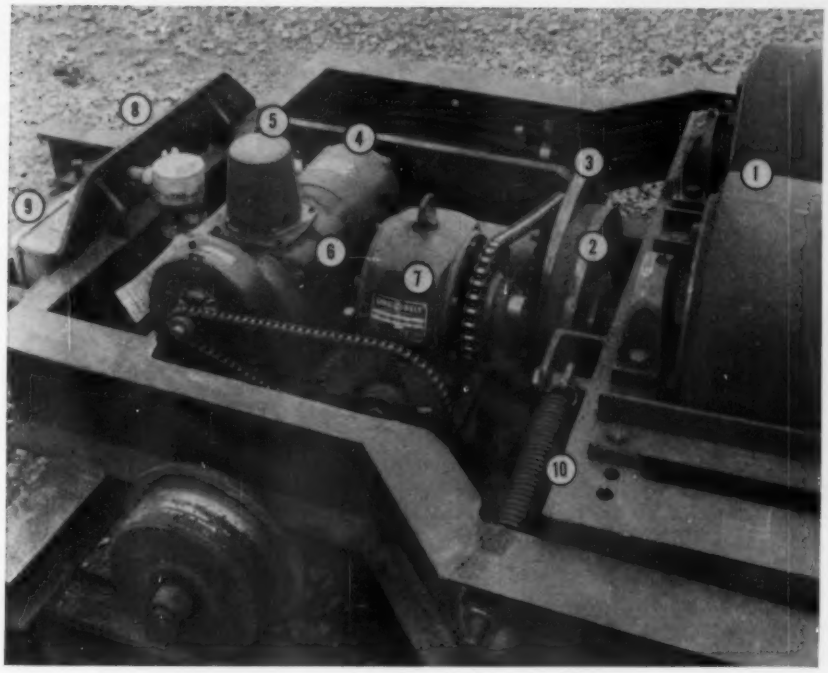
However, the cost of the peak-shaving gas is not the economic factor we are after. The Economics of Peak Shaving Tables 4 and 5 for the two size plants, expressed against the two variable-demand charges, show the added income that the utility can realize from increased sale of firm gas under present contract available gas supplies.

In smaller 50-M.M.c.f.d. plants, it is assumed we are shaving only 30% of the peak requiring 8 days total sendout at the peak rate. Based on 30% added capacity load factor and $0.30 commodity rate gas, the yearly increased firm sales of 5,000 M.M.c.f. would cost $0.46 per M.c.f. against current costs from pipeline contracts of $0.50 per M.c.f. and future incremental costs of $0.98 per M.c.f. We have allowed on $0.80 per M.c.f. value of firm gas above distribution costs.

The 150-M.M.c.f.d. plant has been figured based on shaving 40% of the peak requiring 16 days total sendout at the peak rate. Based on 30% added capacity load factor and $0.30 commodity-rate gas, the yearly increased firm sales of 16,500 M.M.c.f. would cost $0.42 per M.c.f. against current costs from pipeline contracts of $0.47 per M.c.f. and future incremental costs of $0.95 per M.c.f.

The yearly added gross income figures speak for themselves. Higher-load-factor gas will improve the indicated returns but each distributing utility will of necessity have to adjust to its own conditions and costs; but, we feel this is a representative average cost picture that will show favorably on any system with comparable gas rates.

Features of Bechtel's "dog-leg compensator"

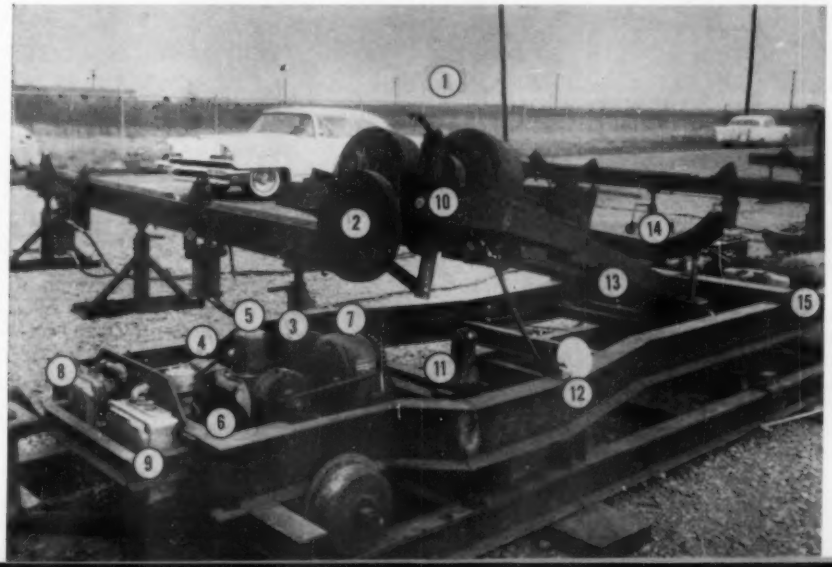


FRICTION DISK CLUTCH (2 and 3) are engaged in typical off-center position for rotating the idler assembly "dog leg" lineup.

Here's how Bechtel double-joints big pipe

LEGEND

1. Idler rollers for alignment and support of one end of pipe rotated for welding. (The two pairs of drive rollers are on the other side of the welding head.)
2. Rubber-covered steel disk which is fastened rigidly to idler roller assembly. This disk is the right half of the friction clutch.
3. Bare steel disk which is the rotated half of the friction clutch.
4. Constant-speed motor for rotating bare steel disk (3) at same speed as that of the drive rollers on the other side of the welding head.
5. Housing for electric motor operating in connection with electrical control for variable-speed transmission.
6. Transmission.
7. Worm gear.
8. Electric-motor controls for motor for hydraulic pump for vertical and horizontal positioning cylinders and friction clutch.
9. Electric-motor control for driving friction clutch.
10. Spring for retracting idler assembly laterally.
11. Plunger of vertical positioning cylinder.
12. Target for sighting while positioning idlers at neutral center position before lineup.
13. Idler frame which is pivoted and hinged to accommodate rotary motion of friction disk clutch.
14. Lowering-in arm for placing pipe on idlers.
15. Motor for hydraulic pump for cylinders for engaging and disengaging friction disk clutch and for horizontal and vertical positioning.



IDLER ASSEMBLY raised to show rubber-covered rigid disk member (2) of friction disk clutch. Rotated disk is 3.

BY PAUL REED
Pipeline Editor

THE TECHNIQUE developed by Bechtel Corp. for completely automatic submerged arc welding has been thoroughly tested in recent weeks.

At two locations a plant has been operating since December for welding 40-ft. joints to make 80-ft. joints of 24-in. diameter. These are produced on a contract with Oklahoma Contracting Co. which is building a 180-mile section of the Coastal Transmission Corp. system. This double-jointing plant has been located at Baton Rouge and Mermenteau, La.

Two innovations in pipeline double jointing have attracted much attention: (1) the copper backup shoe protected by a woven-glass-fiber sleeve, and (2) a special friction disk clutch device for holding the pipe so as to relieve stress at the welding groove during rotation.

These two features were developed for the purpose of reaching the objectives of the Bechtel staff for welding by a completely automatic method

with only two beads—both applied from the outside of the pipe. The aim was to eliminate the need for manual electric welding with a preliminary stringer bead or tack welding. It eliminates need for applying automatic welding on the inside. The Bechtel procedure was planned for simplifying the double-jointing technique.

The procedure was also a step forward in evolution of the art beyond Bechtel's own plant developed in 1947 using a fixed water-cooled copper backup bar for completely automatic triple jointing in Arabia.

The plant was designed for compactness, lightness, and easy dismantling and transportation to another site. Therefore it was initially built for running both beads on a single rack with one automatic welding head.

With this setup it is reported that both beads can be made in 7 minutes —about 8½ welds per hour—for an output of 80 to 85 welds in a 10-hour day. By adding another rack, it is said that 2½ minutes could be cut from the time for making each weld so as to attain a daily output of 110 welds.

Facilities of the plant were designed to take full advantage of the fast lineup characteristic of the Perrault pneumatic lineup clamp. Perrault Equipment Co. designed and built the plant according to Bechtel specifications.

Pipe Alignment

This is how the plant operates:

Pipe comes from the mill with ends of conventional joint design (standard pipe bevels and lands). At the plant rack, pipe ends are cleaned and smoothed with grinders to facilitate fitting. But dimensions of lands are not materially changed by this work.

Air trips move the pipe to electrohydraulically operated carriages. These are regarded as preferable to endo rollers of some other plants.

The pneumatic lineup clamp is pushed manually from a "buggy" at the end of the rack. Pipe is lined up with edges of the pipe butting as snugly together as possible throughout the circumference.

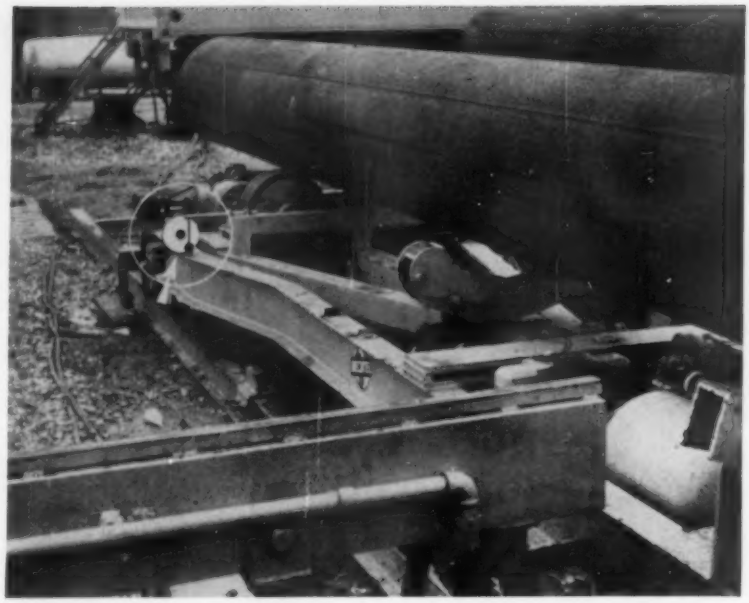
To compensate for the fact that commercial pipe is not perfectly straight or square, a special device featuring a special disk-type friction clutch holds the fitup of the pipe tightly during rotation. Thus it takes the strain off the groove section during welding. This facilitates lineup and eliminates need for tack welding at the bottom for holding the pipe during welding.

This unique operation is accomplished as follows:

Alignment is facilitated by a pair of movable idler rollers which can be positioned horizontally and vertically by means of hydraulic cylinders. Prior to rotation of the pipe, these idlers are engaged by a friction disk clutch, having two steel plates, one of which is covered with rubber. Consequently, when the pipe is rotated it is caused to move in a desired circular motion, not necessarily around the center axis of the pipe. This whole alignment device is called a radial compensator or a "dog leg" compensator. Generally the radius is not more than 2 in.

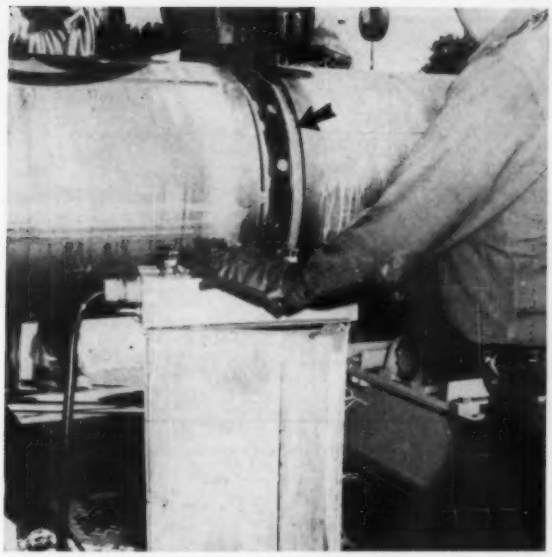
Both sets of drive rollers are opposite the idler positioning rollers.

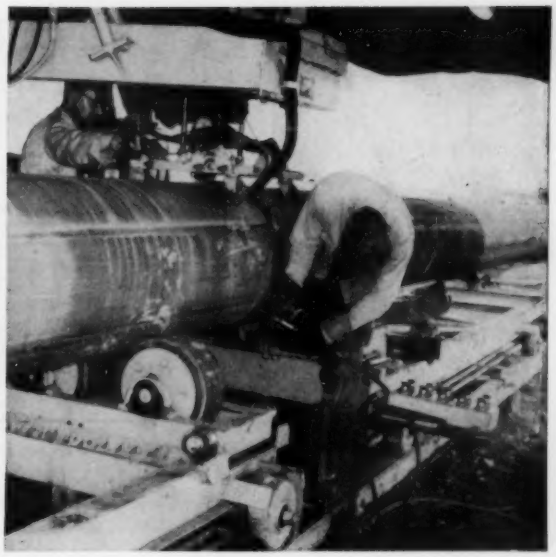
During lineup the springs in the lineup clamp expand the 12 segments of copper backup shoe so as to press a woven-glass-fiber sleeve against the area to be welded. This sleeve is diagonally woven to give flexibility and 1½-in. stretch when it is slipped over



TARGET (circled) for sighting with small black pointer to place idlers in neutral position.

BIRD'S-EYE VIEW of plant and idler assembly.





LINING UP, left: Glass-fiber belt covering copper backup shoe. Plungers press against pipe to insure roundness. Right: Submerged arc welding head resting on a special floating carriage which automatically adjusts horizontally and vertically for holding the electrode at the correct off-center position and spacing on the groove. Welding operator guides electrode along groove. Idler rollers in foreground are on same side of welding head as idlers positioned by friction-disk clutch. Plant's drive rollers are beyond operators and welding head.

the shoe. It is about 1½ in. wide and has double thickness since it is made in the form of a flat collapsed braided tube.

The pliable sleeve rests on a shallow depression in the copper shoe so as to give the molten metal of the root bead a smooth contoured surface. This facilitates complete penetration during the welding operation.

The sleeves are resistant to heat or burning. They are reported as reliable in protecting the copper so that the hot weld metal is not contaminated by copper pickup. During welding the glass fiber becomes charred and is treated as an expendable item.

Cost of the sleeves is considered reasonable and well worth the advantage they give in making it possible to automatically weld with only two beads.

Welding Operations

The welding is done by a Lincoln fully automatic F-LAF-3 welding head, No. 760 flux and ⅛-in. electrode wire.

The welding operator operates air valves which control pipe movement on the feed racks as well as the lowering of pipe on the turning rollers. He operates the turning rollers and controls the welding head.

The spacer—who actually does not space but lines up—operates the carriages and lineup table with a small 10-push-button control panel.

Total arc time is reported as 5 minutes and 15 seconds of the 7 minutes for the whole cycle of lining up and running two beads.

Eight men are being used to operate the plant exclusive of maintenance and supervisory personnel and personnel engaged in hauling pipe to and from the pipe racks.

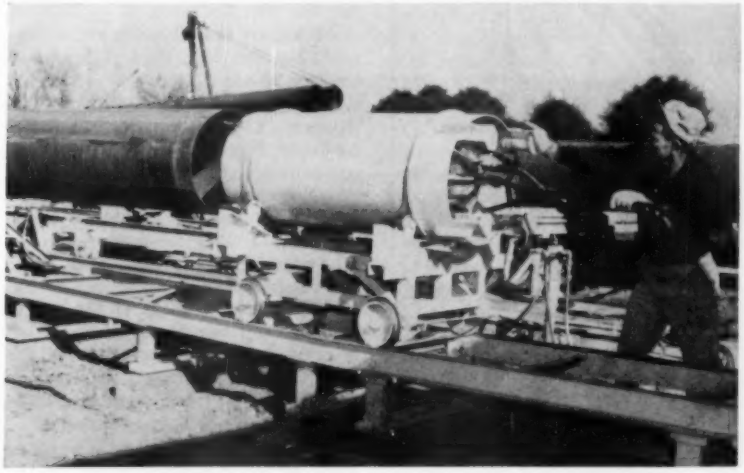
The trailer house weighs 30,000 lb. with diesel generating plant that drives the welding generator unit and air compressor. The trailer, racks, lineup table, and welding head altogether weigh only about 80,000 lb. Therefore, they are all readily portable.

Consideration is being given to mounting the plant on Athey tracks for transportation to points on the right-of-way itself in order to avoid regulatory restrictions against movement of double joints over roads.

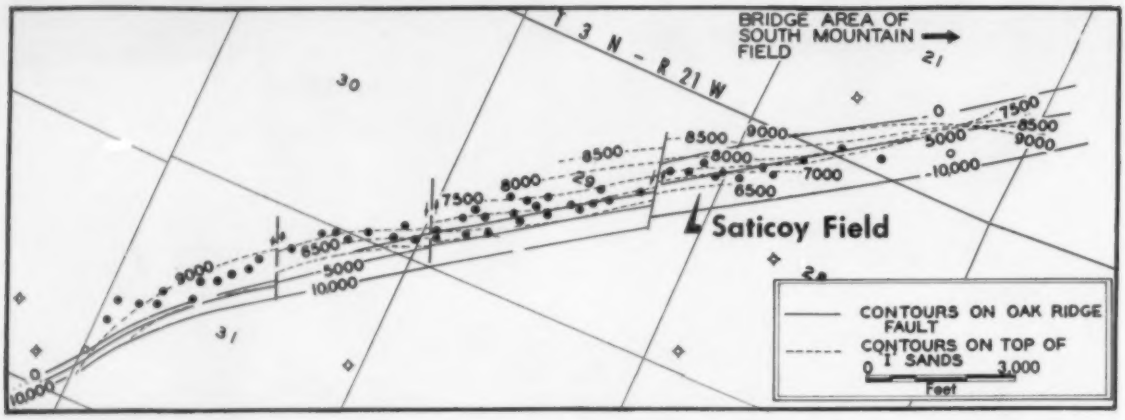
It is generally assumed that submerged arc welding done at a plant on large-diameter pipe costs less than manual electric arc welding in the field. But economies are sometimes obscured by the extra hauling and handling costs for a double-jointing plant. Superior quality of submerged arc welding is recognized.

The important advantage to be had from using the 80-ft. joints is the reduction in over-all spread costs in areas where it is practicable to lay pipe with the long double joints.

Information for this article was obtained from W. L. Kennedy, Bechtel Corp., during a visit to the plant setup at Mermenteau, La.



PNEUMATIC LINEUP CLAMP is being removed from pipe into special buggy.



BOTTOM-HOLE LOCATIONS of Saticoy wells are shown on this structure map. Actual drill site in most instances was somewhere to the northwest.

Sharpshooting by directional drilling

That's how Shell is developing Saticoy field in California, which literally stands on end, and water level varies from sand to sand

DEVELOPING an oil field that literally stands on end always requires pinpoint drilling. When the situation is further complicated by a thick producing section in which the water level varies from sand to sand, the problem becomes even more of a sharpshooting operation.

This is what Shell Oil Co. has found at the Saticoy field, near Santa Paula, in California's Santa Clara Valley. The oil sands have dips ranging from 45° to vertical. Even so, a more or less normal well-spacing pattern has been maintained along the near-vertical "top" of the sands.

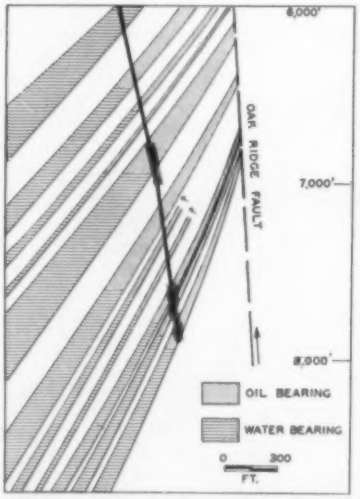
This is accomplished by slanting the wells so that they penetrate the producing section at angles which in some cases are almost perpendicular to the formational dip. As gravity drainage is expected to be an important recovery mechanism, effort also is made to complete the wells not too far above the oil-water contact.

In view of such complicated conditions it might be expected there would be considerable redrilling. There is some, but the average well is completed about 10 days faster than those of a year or 18 months ago. Avoiding bottom water accounts for most redrills.

Improved techniques account for part of the faster drilling but knowledge of the field has been the more important contributor. Choice of the well site has a bearing on drilling time.

BY D. H. STORMONT
West Coast Editor

Fault-line development . . . Located about 2 miles southwest of the town of Santa Paula, Saticoy was discovered by Shell in 1955. Except for five wells completed by another operator, Shell has developed the entire field for itself, General Petroleum Corp., and Superior Oil Co.



SCHEMATIC CROSS-SECTION, showing the steeply dipping sands butting against the Oak Ridge fault. Varying water levels lead to occasional redrilling.

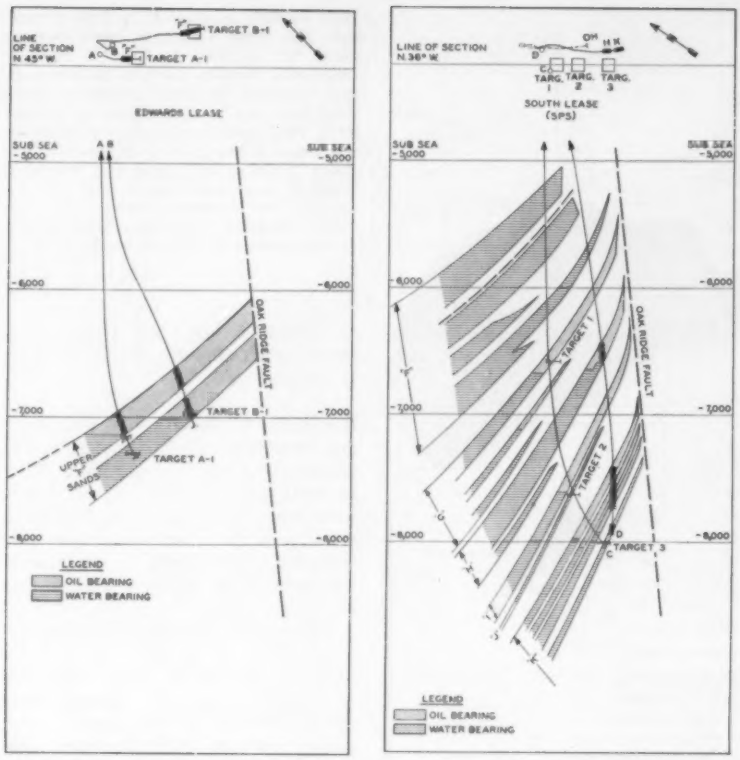
A field over 3 miles long has been proved by the 55 wells completed to date. Because of the steep dip of the producing sands, however, the field is not over two locations wide at any point. In some areas it is only about 600 ft. wide, as indicated by the contours shown on the accompanying map.

Less than 1 mile now separates Saticoy from South Mountain's Bridge pool on the east. Production there is likewise from steeply dipping sands which butt against the north side of the Oakridge fault. Though yet to be proved by the drill, oil production probably will be continuous throughout the undrilled area.

At Saticoy the oil sands are underneath the Oakridge fault at depths of about 6,500 to 9,500 ft. Six principal sand groups are present, with the upstructure closure provided by the southerly dipping thrust fault (see accompanying typical cross-section). Lateral closure is thought to be provided by crossfaulting. The producing sands are in the Pico formation (upper Pliocene age).

As reflected in the contours on top of a middle sand member (see map), the beds dip northward at angles of about 45° in the western part of the field. The beds progressively steepen to the east and are believed to be vertical on the present east edge.

Only one sand member is encountered in the western portion. In the other fault blocks there are four to



TYPICAL PLAN (top) and cross-sectional views used by Shell in planning Saticoy wells. During drilling the plots are used to guide each well into the target areas.

six sand groups, separated by shale or siltstone intervals up to 200 ft. thick. Though the stratigraphic thickness of the producing interval is as much as 2,000 ft. thick, the average well penetrates only 1,200 to 1,500 ft. of section.

Because of differences in reservoir characteristics, earlier wells penetrating more than one sand group were dually completed. This practice is no longer followed. All sands which can properly be drained are included in a single well bore.

Drilling practices . . . The average Saticoy well is assigned targets (usually 100 by 100 ft.) in three zones. Drilled depths to these targets vary from well to well but in general they fall within 6,800-7,750 ft., 7,800-8,400 ft., and 8,600-9,100 ft.

Every well drilled is directionally controlled and almost all are slant holes. Maximum horizontal travel of any well is only about 1,200 ft. But in some wells a drift (angle of inclination from vertical) as high as 67° is attained when the last target is reached.

On earlier wells it was noted there was a tendency for holes to bear to the northwest at depths up to about 5,000 ft. Then they would tend to drill back to the southeast.

Before advantage was taken of these deviation tendencies, about 30 days were required to bottom a well in the 8,000-ft. target. Usually six to eight whipstocks were required. Where the hole had to be redrilled two or three times in order to miss bottom water, 60 to 70 days of drilling frequently were required.

Practice now is to choose the surface location so that it will result in minimum directional work. In other words, each well is planned from its subsurface targets. This results in the drill site being selected several hundred feet northward from where the well is to be bottomed.

The average single-fork well now requires two or three whipstocks for directional control. A "hole-in-one" was achieved at one, however. The hole deviated exactly as planned so that it entered the top target without a single whipstock being set.

Average drilling time for each well is about 10 days faster than before. This is principally due to the driller being able to carry more weight on the bit down to the kickoff point; knowing that the hole is going to drift along the planned course, he doesn't have to hold back in order to keep the hole straight.

One recent well required only 14 days to reach 7,500 ft. The lower portion of the hole had to be redrilled, requiring two whipstocks, but total drilling time was only 25 days for a two-fork hole and completion.

How each well is planned is shown in the typical plan and cross-sectional views. As the plan view shows, the hole is expected to bear to the northwest before a kickoff point of 5,000 to 6,000 ft. is reached. At that depth a whipstock is required to start the hole along the planned course. If it fails to stay on course, whipstocks are run to guide the hole into the target.

As the cross-sectional view indicates, a near-vertical hole is drilled to the kickoff point. After drilling off the whipstock, drift angle is built up at a rate not to exceed 3° per 100 ft.

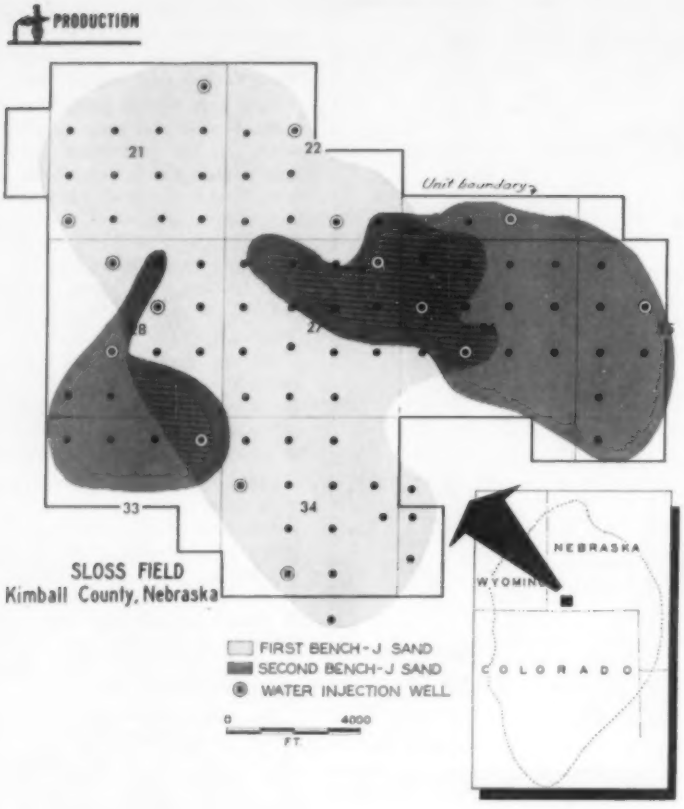
Once the desired drift is reached, it is maintained through the proper positioning of stabilizers in the drill string, and through choice of the size drill collars used. For example, if it is desired to build angle, a stabilizer is placed immediately above the bit. Or 6-in. drill collars may be run instead of 7½-in. if rapid buildup of angle is desired.

In drilling the upper part of the 9⅞-in. hole, from 30,000 to 35,000 lb. of drill collars are applied. When the kickoff point is reached the amount of weight carried on the bit varies according to what must be done. Depending upon the situation, from 10,000 to 35,000 lb. may be placed on the bit. Holes stand up well and no trouble is had with lost circulation. Rotary speeds used in the directional hole range from 60 to 250 r.p.m.

Locating the wells to obtain the optimum drainage position in all sands is possibly the most difficult problem connected with the slant-drilling operation. This, at times, results in penetrating one of the zones below the oil-water contact and frequent plugbacks and redrills have been required. In general, the wells have been positioned low on structure to take advantage of possible future gravity drainage. Average water cut for the field has increased until it is now about 32%.

Obtaining water shutoffs is a problem due to the thin shale breaks between water and oil sands. Centralizers and scratchers are run on the casing, and pipe is reciprocated during cementing when possible. Despite these measures, squeeze jobs are not infrequent, particularly when the casing sticks and cannot be reciprocated.

Shell is keeping three rigs at work at Saticoy. The western portion has been fully developed but drilling is continuing in the eastern part.



THIS FLOOD, operated by Pan American Petroleum Corp., is identified as Field "H" in Table 1. The "J" sand is frequently broken up into as many as four benches by shale stringers. Sloss field has two such benches, as shown here. Pan American engineers describe the flood pattern as a staggered line drive. Calculations show that this type flood is most economical and will result in the highest recovery in this field. Injection wells have been chosen to adequately flood all sands.

Know why they're water flooding in the Denver basin?

...FAST PAYOUT

Recoveries are increased by about 50%, and pipeline companies like this Denver basin high-gravity, sweet crude.

BY W. B. BLEAKLEY
Production Editor

NEW WATER FLOODS are popping up everywhere in the Denver basin these days. And there is good reason, too. While it doesn't cost much to drill a well to the "D" or "J" sand, the wells are expensive, because of the small amount of primary reserves that a well will usually produce.

Recoveries of 14 to 35% can be expected from primary operation of a Denver basin field, and 1,000 bbl. of oil in place per acre-foot of sand is an unusually high figure for the area. Net sand thickness varies from zero feet at the pinchout to a maximum on the downdip side, and these maximums aren't very big; 45 to 50 ft. is considered good.

Recoveries increased . . . Water flooding, according to laboratory tests, will increase the recovery to about 50% in most cases. None of the floods have been in operation long enough to prove these expected results, but their behavior is according to predictions, and there is no reason to believe that flooding won't work.

Flooding is attractive for other reasons. There is no proration in Colorado, and production is restricted only by pipeline purchases. Denver basin oil is attractive to the pipeline companies because it is a sweet, low-viscosity, high-gravity crude. With the demand for this crude, operators can see a faster payout for their wells by investing a little more in water-flood equipment.

Area geology . . . The Denver basin is an asymmetrical northward-trending syncline that includes eastern Colorado, southeastern Wyoming, and southwestern Nebraska.

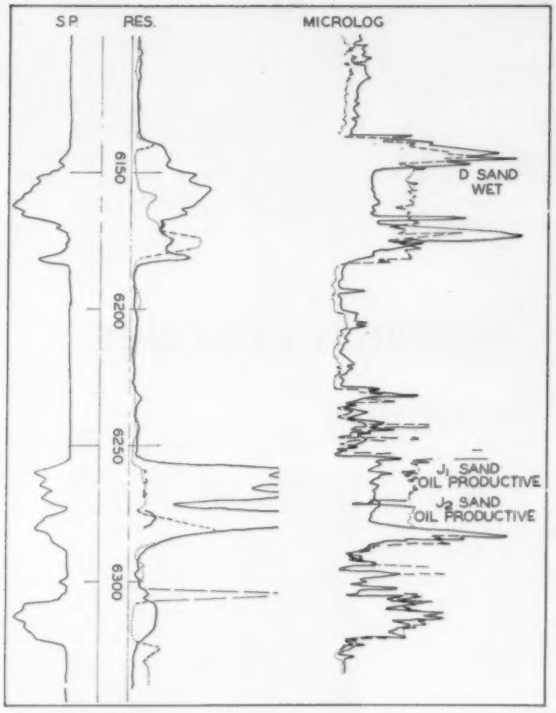
The basin is bounded on all sides by major geologic features; on the northeast by the Chadron arch in West Central Nebraska; on the southeast by the Las Animas arch; by the Apishapa uplift on the south; on the west by the Front and Laramie ranges; on the north by the Hartville uplift, and on the northwest by the Black Hills uplift.

The producing formations of the Denver basin are the Upper Muddy

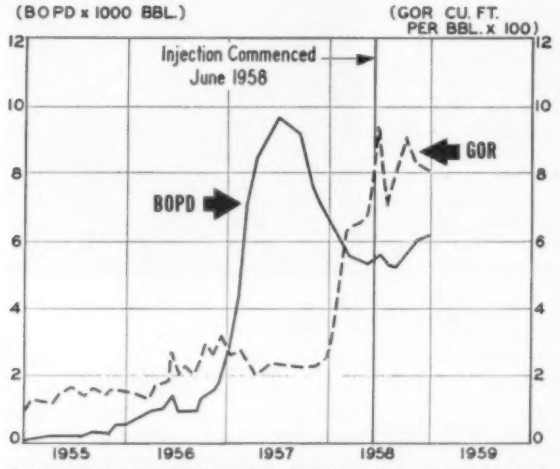
TABLE 1—CHARACTERISTICS OF SEVERAL

Field	Trap type	Sand	Porosity (%)	Permeability (md.)	Connate water (%)	Injection rate (bbl./day)	Injection pressure (psi.)
A	Strat. some closure	D	19	240-590	25-30	30,000	400
B	Strat. some closure	J	23	340-350	25-30	15,000	600-800
C	Strat.	D	20	400	20	2,000	950
D	Structural closure	D	19	225	38	8,000	100
E	Strat.	D	18.5	. . .	35	5,500	. . .
F	. . . . .	D	20.2	190	28	new flood	
G	Strat.	D	17.4	282	30	new flood	
H	Strat.	J	17.6	150	. .	12,000	450

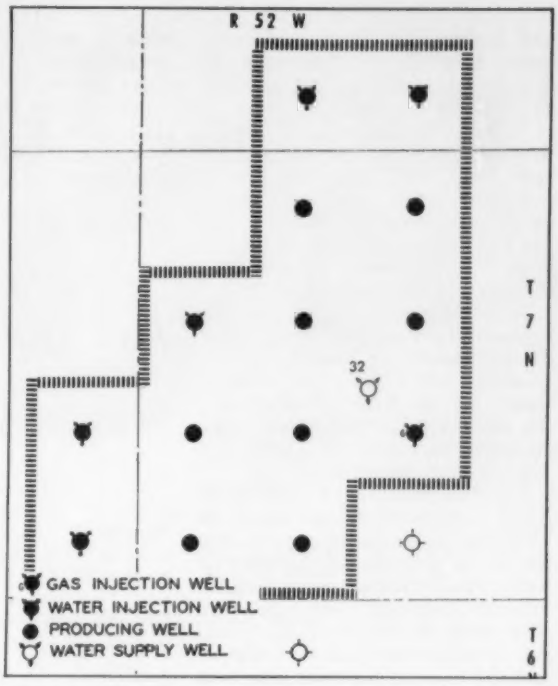
*Vaughey & Vaughey pipeline (OGJ, Feb. 16, 1959, p. 142).
†Author's estimate.



ELECTRIC LOG of a well in center of Sloss field. In this field, the "D" sand is not productive, and the productive "J" sand has two well-defined benches.



PRODUCTION PERFORMANCE CURVES, Sloss field, Kimball County, Nebraska. Curves show almost immediate response to water injection.



DUNE RIDGE FIELD, Logan County, Colorado. This field, operated by Shell Oil Co. (Field C in Table 1) is being flooded on a modified line-drive pattern. One gas well in the southeast part of the field is to be converted into a water-injection well. There are many examples in the Denver basin and elsewhere of floods that do not follow regular patterns because of: (1) irregular oil-water contacts, (2) spacing regulations, (3) economics of using existing wells, and other reasons. While classified as a line-drive flood, Dune Ridge lacks only a few of the essential features of a peripheral flood.

WATER-FLOODING PROJECTS IN DENVER BASIN

Water source	Flood type	Well spacing acres per well	Oil in place bbl. per acre ft.	Primary recovery bbl. per acre ft.	(%)	Est. additional recovery from flood bbl. per acre ft.	Total recovery (%)
*Pipeline	5-spot	20	†1,030	†360	†35	†185	†53
*Pipeline	5-spot	40	†1,250	†375	†30	†150	†50
Shallow wells	Line drive	40	995	348	35	183	53
Shallow wells	5-spot	20	743	197	27	149	47
Shallow wells	Peripheral	20	746	226	30	161	52
*Pipeline	Line drive	20	1,128	156	14	144	27
*Pipeline	Peripheral	40	788	126	16	81	26
Shallow wells	Line drive	40	(Reserve figures not available. Water flood should increase ultimate recovery by about 60% of primary)				

and Muddy sandstone members of the Graneros shale formation in the Dakota group of Cretaceous age. These two Muddy members are locally referred to as the "D" and "J" sands. They are often found with shale stringers separating two to four benches in each.

Reservoirs in the two producing sands are mostly of the stratagraphic type. A few reservoirs have shown some structural closure, but these are exceptions to the rule.

How operated . . . Most of the floods follow the same general pattern of operation. The one big exception is the Adena flood (OGJ, Sept. 23, 1957, p. 121), in which water is injected at the gas-oil contact. Denver basin floods as a rule fall in three conventional classes: (1) five-spot, (2) line drive, or (3) peripheral floods. In a group of floods studied, all three types were found in operation (Table 1).

Water source . . . Few operators have reported any difficulty in finding injection water. Most operators are getting their water from shallow wells,

and at least five floods are taking water from the pipeline built by Vaughey and Vaughey, Denver (OGJ, Feb. 16, 1959, p. 142).

Water treatment . . . The "D" and "J" sands will both take fresh water. Treatment, other than filtration, is rarely used. Some operators are making tests, and expect to treat the water with bactericides and iron sequestering agents in the future.

In the Adena field, Pure Oil Co. engineers have detected the presence of sulfate-reducing bacteria in the produced water. Since this water is mixed with the fresh injection water, the entire stream is being chlorinated. Inhibitors were used for a while, but this has been discontinued.

Injection pressures as reported in Table 1 represent, in some cases, the capacities of the pumps, rather than the actual pressures on the injection wells. Many wells are taking water at very low pressures, and little more than the hydrostatic head of a tubing full of water is required to cause injection. Pressure increases have been reported in some injection wells, but these are rare, and the pressure increases have been of small magnitude.

Well spacing . . . In the group of floods investigated, well spacing was about equally divided between 20-acre and 40-acre development. Spacing apparently has no influence on the choice of flood pattern, as each of the three types was represented at least once in a 20-acre layout and once in a 40-acre development.

Gas injection . . . At the time of writing, gas was being injected into one gas-cap well of the Dune Ridge field. Preparations were being made to convert this well into a water-injection well, however. None of the other fields studied had a history of gas injection.

Reservoir mechanism . . . All fields covered in Table 1 were operating under solution gas drive. The producing characteristics were typical of fields of this type. Gas-oil ratios increased rapidly, as the reservoir pressure declined, then dropped off slightly. There was practically no water produced, and no record or indication of an active aquifer. Engineers have estimated that water flooding will restore some of the lost reservoir pressure and reduce the high gas-oil ratios.

Some reservoirs in the area were undersaturated originally, and the gas-oil ratio has not increased as rapidly in these fields, as in those that were saturated.

Want to start a flood? . . . Based on the experience of the operators of the floods covered in this report, most of the fields in the Denver basin producing from the "D" or "J" sands can be flooded with a minimum of reservoir information. A good contour map and a source of injection water, plus the necessary equipment should put any operator in the water-flood business. Caution should be exercised, of course, if any unusual conditions are present. For the most part, operators have been able to use existing wells, and only in a few cases have special wells been drilled to secure optimum locations for injection or production wells.

Arc gouging torch provides welding flexibility

TOP-FLIGHT MAINTENANCE of petroleum producing and refining equipment often hinges on the right welding techniques, with the key to good welding lying in proper preparation. Thorough weld preparation usually means extensive metal removal, and the arc gouging torch has become a versatile weld preparation tool at the central mechanical shops of the maintenance and construction division of Esso Standard Oil Co.'s Bayonne, N. J., refinery.

Welding engineers at Bayonne first turned to the arc gouging torch some years back in the construction of storage tanks. Completely eliminating the usual back chipping required in readying tank sections for welding, the torch provided the added advantage of assuring 100% welds, since it was found impossible to cover up metal defects. Whereas gun chipping can pass over a porosity hole, leaving a smooth-looking surface, the gouging torch is relentless in removing all defects.

Once a flaw is found, an operator using an arc-air torch can quickly and easily remove every trace of bad weld metal. Back gouging makes it impossible to cover up slag and defects in root welds. Therefore, flaws that would otherwise show up only under X-ray examinations are removed prior to final welding operations.

Lately, Esso's Bayonne welding engineers have developed techniques for using the gouging torch in a wide range of maintenance and repair jobs. The torch is used almost daily in repair work in tanks, piping, heat exchangers, pumps, and other equipment.

Pump repair . . . A good example is the illustrated pump-repair job. A centrifugal pump used in wash-oil service developed a crack in the casting. The gouging torch was used to vee out the crack, prior to welding. The process uses a carbon arc to melt,

ARC GOUGING TORCH being used on a pump-repair job.

and a jet of compressed air—80 to 100 psi.—to remove, the molten metal. With the casting at negative polarity and the gouging electrode positive, the torch quickly removed metal adjacent to the crack by means of a jet of compressed air directed parallel to the electrode.

The air blast not only removes the molten metal rapidly, but serves to cool the work piece, too. The welding generator was set at 220 amp. for this job. Compressed air at about 90 psi. was supplied by a manifold system from a central compressor in the shop. Following the quick gouging operation, the pumps casting was smoothed on a grinder, and then heated to 600° to 700° F. on a charcoal fire prior to welding.

The torch is made by Arcair Co., Lancaster, Ohio.

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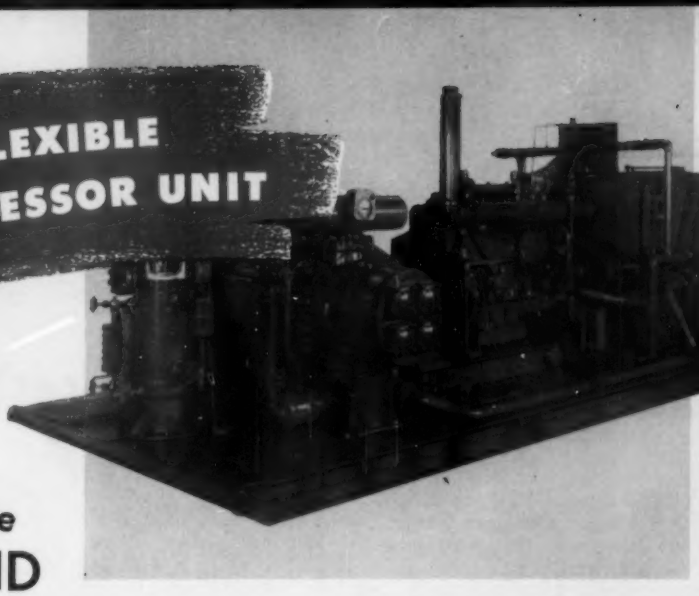

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Worried supply companies are now wondering whether . . .

Suppliers may have to trim services

THE OIL INDUSTRY, long accustomed to unstinting service from its supply stores, may have to content itself with something less.

During the past year, some supply stores were threatened with having to close their doors. While their situation has improved slightly, many say that it's only a matter of time until they will have to cut down on deliveries and field-service work or to charge for these things.

The past year was one in which no supply house made a satisfactory profit; a few made no money at all. Harsh competition for a shrunken market was the big reason for this situation, but some unthinking practices by purchasers helped aggravate it.

Actually, it has been several years since oil-industry supply stores made a profit that would seem fair in other industries. If this situation continues, the supply companies' managements owe it to their stockholders to take action. Such action would almost certainly mean cutting operating costs, including service to customers.

Less than 2% on the dollar . . . Each year a leading firm of auditors surveys most of the country's supply firms. The 1958 survey, just concluded, showed that the average supplier is retaining a profit of less than 2 cents on his gross sales dollar. In no industry is 2% considered to be enough return. Government bonds, safest of all investments, pay more than this.

An unprofitable year is no stranger to the other segments of the oil industry. Recently in the pages of the Journal, we have printed thousands of words about the disastrous position of the drilling contractors and about the woes of domestic oil producers and others. But there has been little mention of the situation in which our supply stores find themselves. The supply houses, service companies, and manufacturers are just as much a part of the industry as are drillers, producers, pipeliners, and refiners. Like the rest, the supply companies feel they have the right to a fair rate of return for their work.

You never miss the water till the well runs dry. The oil industry probably won't realize the magnitude of the service it gets from its supply stores unless it should lose part of that service. While things are now looking up, there's still a real danger that supply companies will have to trim their pattern of service.

BY ED McGHEE
Drilling Editor

Are services worth keeping? . . . The oil industry has come to expect a high standard of service as a normal way to do business. When some kind of change has been so close, the question is, "Is the service rendered by supply stores useful enough to justify keeping it unchanged?" To answer this question we must list the things that supply houses do.

First, the supply houses are the warehouses of the industry. Time has proved that supply stores can do the warehousing better and cheaper than the operating companies themselves. If this were not so, the big companies would have continued to do their own warehousing as they did 30 and 40 years ago.

Today, no major company cares to do any more warehousing than is absolutely necessary. If suddenly forced to do without the supply stores, these companies would need to hire a small army of warehouse employes. Millions of dollars would have to be tied up in capital investment for warehouse facilities. Interest on the money tied up in warehouse inventory would be a big expense.

If oil companies had to revert to doing their own warehousing once more, they would again find themselves writing off a big loss each year caused by inventory becoming obsolete. Because they centralize warehousing, supply stores protect their customers from this obsolesence loss. Moreover, supply stores eliminate any loss to the company from damage in transit, misplacement, or theft.

None of this is conjecture. For proof of it, look at the operations of the producers who operate overseas. In almost all of these foreign lands the companies have had to set up their own warehouses because none existed before. And, gradually, these companies have accepted the supply companies where it became economical to set up stores in a particular country—such as Venezuela.

The foreign operators know that the cost of their material comes down as the percentage they buy from local supply stores goes up.

In oil-producing areas of Canada and Venezuela, all segments of the industry know they can get what they need, when they need it, from a local supply store.

Oil companies and contractors more often are finding it cheaper to aban-

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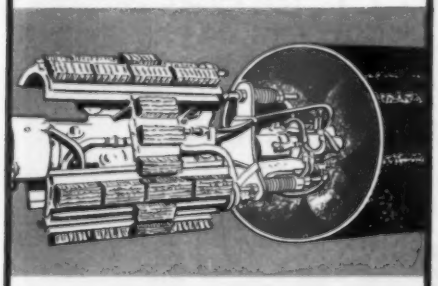
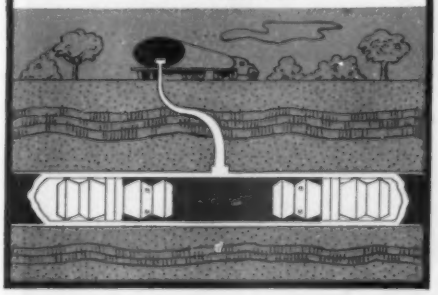


PIPE IN GROUND



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don their repair and machine shops for many of the same reasons they abandoned their warehousing. Supply companies with centralized facilities usually can do this work cheaper.

Do majors need technical aid? . . . Another important service of the supply store is in bringing new technical developments into actual field use. Supply firms employ hundreds of engineers and specialists whose purpose is making sure that the customer gets the most efficient equipment and that the equipment gives its best performance. Not many years back, engineers were few among oil producers and drilling contractors, so most everyone relied heavily on the suppliers for technical information and news of improvements in equipment and methods. Some contractors and small producers still rely heavily on suppliers to solve technical problems. But, over the years, the function of the supply-house engineer has changed.

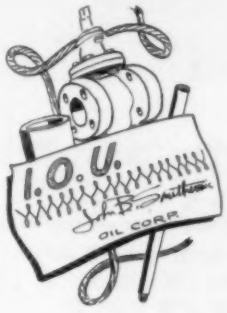
Since most producers now have engineers throughout their organizations, some may get the idea that they get no benefit from the suppliers' engineers. Perhaps this is true in that the suppliers don't solve differential equations for major companies. Still, the supply companies contend that major oil companies, with all their engineers, stand to profit as much from the work of the supply-house engineer as does the smallest contractor.

Their reasoning is based on the fact that almost all equipment research is still done by the manufacturers. When this research gives birth to improvements, getting these improvements into actual field use is still the job of the manufacturers' outlets, the supply houses. The supply company must have men with engineering training who can explain to major-company engineers the technical reasons behind the changes. Then, these men must aid in the selection of the equipment, in its installation, and its operation.

As we said above, many drilling contractors still rely on the suppliers to answer technical questions. These contractors drill an overwhelming majority of the major oil companies' wells. Any help the supplier gives the contractor also helps the oil company. By themselves, the major companies find it difficult to bring improvements into the operations of the contractors. It takes the suppliers' help. And the suppliers have given it.

Credit helps all, too . . . Suppliers have always been proud of the fact that there would be very few drilling contractors indeed were it not for the credit extended supply stores. Contractors have always been glad to have this ready source of credit.

Major oil companies don't need this credit. Some have voiced the opinion that availability of credit is no real service to them. Perhaps this is true in the short run. But, in the long run the fact remains that the majors need contractors. And contractors need credit. When suppliers extend credit to contractors, they are helping to maintain something that the majors cannot easily do without.



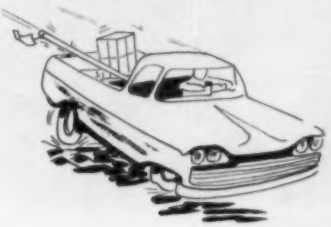
Supply-store credit helps major companies in another way. This help comes indirectly through the small, independent producers. Quite often, these small producers cannot qualify for the bank loans. They can, however, frequently find credit at the supply store. It is these small producers who regularly take farmouts on properties which the major companies cannot themselves produce profitably. Because of his supply-store credit, the small operator can often make such farmed-out property profitable to himself and to the company which gave the farmout.

Field service and claims . . . One of the most easily appreciated of the things done by supply stores for their customers is servicing their equipment in the field. The supply-company men can do a better job of field service because they are familiar with the equipment, have the replacement parts and because it is to their best interest that the equipment perform well. Certainly the contractors, producers, and the like could do their own equipment service but it would be more expensive than letting the supply stores do it.

And, as they say is their duty, the supply companies have maintained a record of fast, liberal settlement of claims against their equipment.

Camel in the test . . . It's impossible to discuss the services, and the problems, of supply stores without mentioning delivery. A large portion of all goods sold by supply stores is delivered to the rig, well, or plant.

Customers like the delivery service. Speedy deliveries have spoiled many to the point that they consider the supply store merely an extension to their own tool box. If what you want isn't lying on top of the box, just pick up the phone and ask for it. It'll be there in a few minutes.



Delivery was started by the supply stores to gain the good will of the customers. But as time has worn on, some customers who normally made frequent trips to the supply stores lost the incentive to anticipate their own equipment needs. Now, instead of looking ahead, ordering in sufficient quantities for emergency needs, and carrying away what they can themselves, these customers order only what they need for the remainder of the day. And they want everything delivered even if they could carry the goods themselves. The result is frequent, costly deliveries of small orders.

Any change, a loss . . . Most men in the oil industry, fully aware of the services we've just reviewed, believe that any significant change in the structure of the supply-store system would be a loss to all. Few would like the loss of services of their store and no one would like to see the supply store in his area close. Anyone who moves into a new area is always glad to see that a supply store is already there. If there is none, no one cares for a prolonged wait for a store to open in the area.

Where does trouble lie? . . . Most of

Congrats and $25 to Mr. D. J. SUGGS, Republic Natural Gas Co., Tipton Bldg., Pauls Valley, Okla., for this quip.

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the trouble facing the supply stores can be traced directly to the drop in drilling and other activity in the oil business during the past 2 years. This was the same business recession, of course, that drove many drilling contractors and others completely out of business.

The supply segment of the oil industry is fiercely competitive. It could hardly be otherwise when more than 146 supply firms operate at least 1,147 stores throughout the oil country. This is entirely in keeping with the rest of the oil industry which is also strongly competitive. Competition has been the thing that fostered the many customer services that supply stores came close to dropping in order to stay in business.

This same competition has fostered price cutting by some "ambitious" suppliers. These price cutters seek a short term gain for themselves but actually hurt everyone by undermining price structure. Just as unstable prices are disastrous in the crude-oil and refined-products markets, they can be ruinous to suppliers. Everyone should recognize the price cutter for what his action causes.

Manufacturers and suppliers . . . Suppliers have one kind of competition that is peculiar to them. This competition is the shoe-string operator who can bid on, and sometimes get, even the biggest orders. The shoestring operator we refer to is the individual who gets a factory account for sales but who gives no service.

It has always been easy for an individual to get two or three manufacturers to allow him to act as their sales agent. Armed with these suppliers and little more than a telephone, this individual can bid on any oil-company order that is factory-shipped. He can bid low because he has little overhead and gives no service after the sale. If this individual has friends in the purchasing company, he can sometimes get the order.

Such low-overhead operators can always underbid the established supply houses which must give service after the sale and which must carry a complete line of operating supplies and repair parts. In the words of one oil-company purchasing agent, "These little outfits are bleeding the rest of the supply business white."

As a result, most suppliers feel that the manufacturers should be more careful about whom they give their accounts to. Or, some suppliers suggest, the manufacturers might consider giving a volume discount to the suppliers who handle greater amounts of a particular item of equipment.

Another point of contention between manufacturers and suppliers is direct sales by the manufacturer to the customers. There has been a fad in all businesses to "cut out the middle man and his profit." This thinking has fostered the "discount houses" and "factory outlets" which have sprouted up in consumer sales. The idea seems to have spread to oil-field-equipment sales for there has been a rash of direct sales lately.

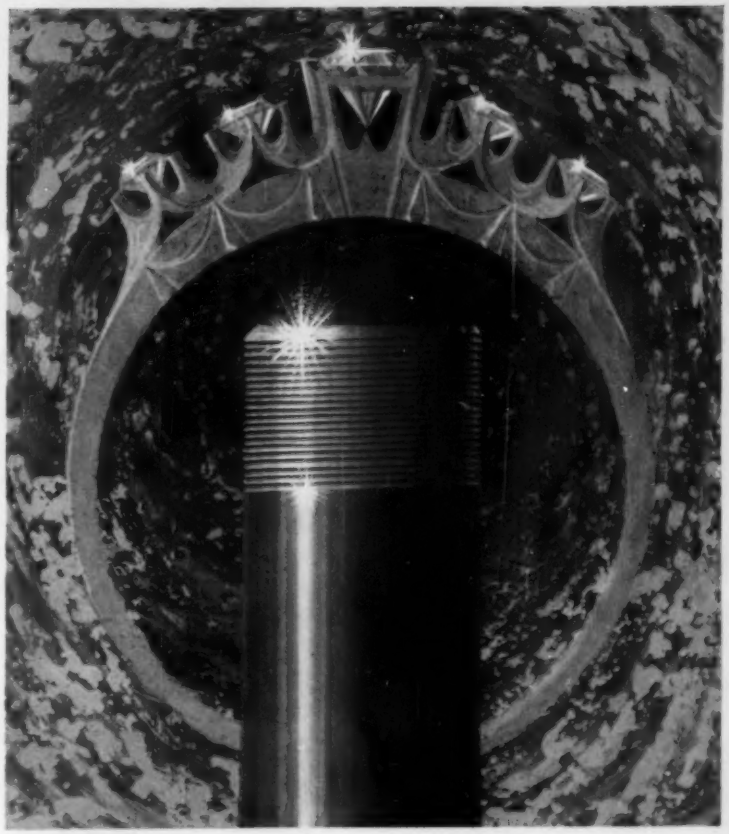
Many suppliers aren't too worried about direct sales over the long run. They say that about as many manufacturers abandon this practice each year as take it up. The manufacturers soon find themselves forced to duplicate the services of the supply stores, and they often find the supply stores perform these services cheaper.

Frequently, the purchasers, too, decide that direct purchases aren't satisfactory in all cases. Where manufacturers can't duplicate the supply-store service, these purchasers go back to their old practices of buying through the store.

Direct sales often work an immediate, short-run hardship on the supplier affected. This, added to his other problems, can have a big bearing on his decisions about trimming services to customers.

Purchaser abuses . . . Few supply men lay much of the blame for their ills onto their customers. As you'd expect, they say, there are a few unthinking individuals who cause them trouble, but most purchasers are just as considerate and cooperative as in any other business. Suppliers realize that oil companies have their problems too and they must often take advantage of low prices brought on by a soft market.

The suppliers do say that their cus-



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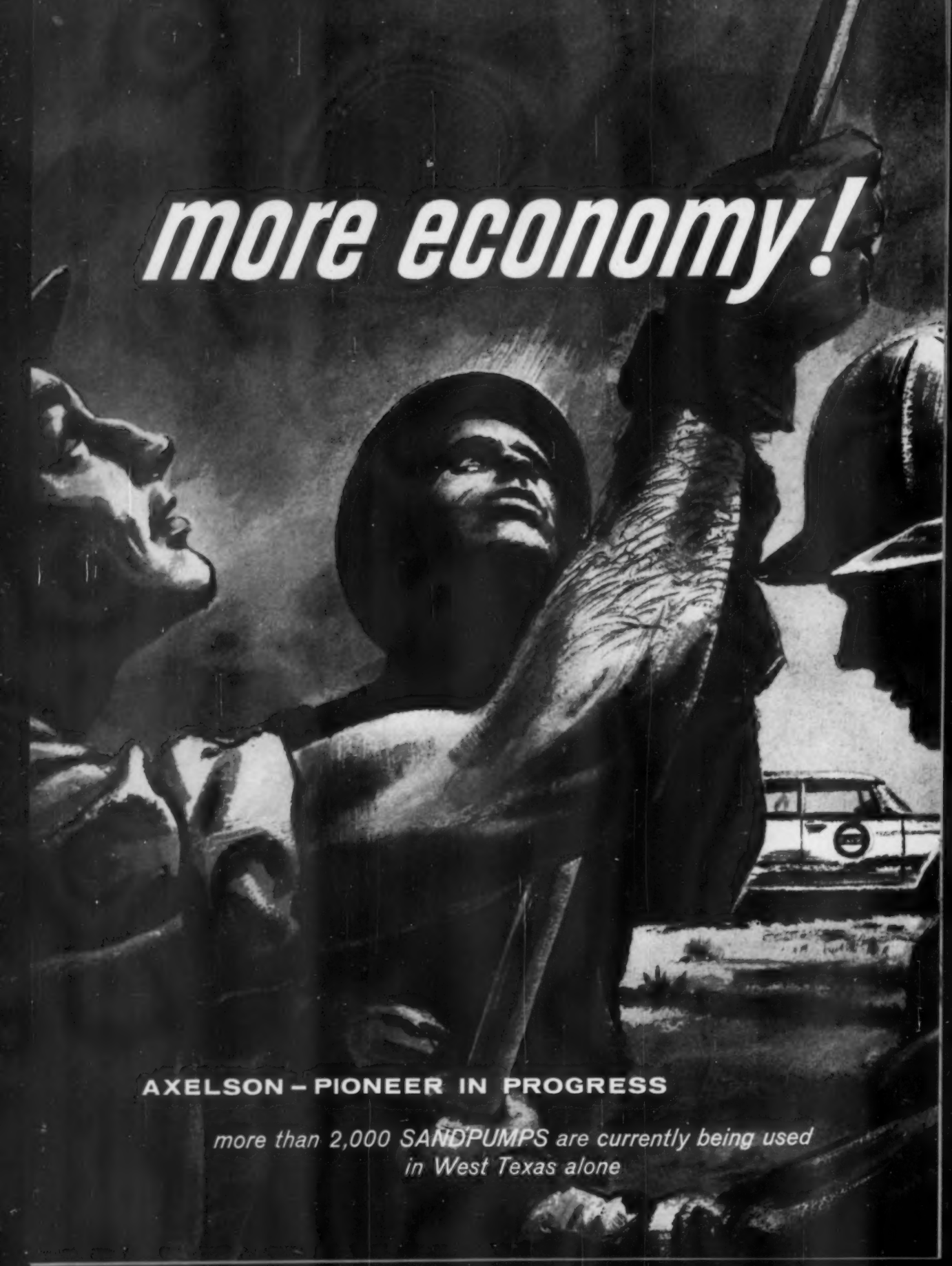
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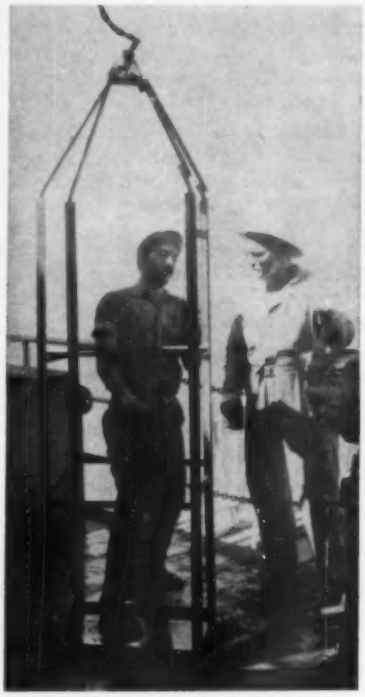
tomers could be of help if they would make a point of doing these things:

1. Bunching orders for small items.
2. Picking up whatever they can at the supply store.
3. Looking ahead on orders so that deliveries will be less frequent.
4. Assigning a man to help the supplier's service man when he calls.
5. Foregoing claims on small items where processing the claim would cost more than the items themselves.
6. Not expecting the supply house to accept junk equipment as trade-in on new.



Metal basket aids topside work

WHERE it is necessary to work on the blowout preventers on offshore rigs or up in the derrick, a basket such as the one shown rigged up by Cecil Parsons, tool pusher for Perforaciones de Mexico (ODECO) will make the task easy and safe.

The basket is approximately 20 in. by 30 in. across and 7 ft. high. It is made from angle iron and comes to a pyramid at the top where the derrick line from the air winch is attached.

With this device, the derrick man can be spotted at any point above or below the derrick floor and be able to work without having to hang on precariously.

Type "46" Bethlehem Rods Pump Ashland Well in Oklahoma

Bethlehem Type 46 Sucker Rods are currently in service in a 5970-ft tapered string in the Boucher No. 1, an Ashland Oil & Refinery Co. well in the Orchard City Field, near Oklahoma City.

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In addition to the "46" rod, Bethlehem produces other types of carbon and alloy steel sucker rods, thus enabling operators to choose rods best suited to any given fluid condition. We also manufacture a full line of sucker rod accessories.

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BETHLEHEM STEEL

BETHLEHEM STEEL

BY W. L. NELSON
Technical Editor and
Petroleum Consultant

Questions on
TECHNOLOGY

Economical size of refineries

What is the economical size of a refinery? A.G.M.

There is altogether too much concern over the economical size of a refinery. Economy depends perhaps more on the type of management than on size, i.e., a small plant can be ineffective and a large plant can be very economical and vice versa depending upon how the plant can be managed.

The management of a small organization or small plant is relatively easy. The small organization has many inherent advantages such as freedom from committees, ease with which decisions can be shared between operators and management, ease with which responsibility can be defined, rapidity with which decisions can be formed, freedom in some degree from criticism by society, and the possibility of intimate friendship and confidence between management and the refinery operators.

Thus although the management of large organizations may be highly effective or in a sense more efficient in meeting its complex problems than small company management, large-organization management works at a great disadvantage and therefore is not usually as effective as small-company management.

The results of the difficulties of large-company management are evident in Fig. 1 which shows that large organizations must employ more workmen per barrel of oil processed than smaller refiners and that the investment per barrel in large refineries is far greater per barrel than in small refineries.

With respect to size, it is only

TABLE 1—APPROXIMATE PROFITABILITY OF VARIOUS SIZES OF 1950 REFINERIES

	173 smallest	60 refineries	85 refineries	15 refineries	10 largest
Capacity, B/D	2,780	8,150	28,000	93,500	183,180
Workmen/10,000 B/D	252	212	197	227	247
Invest., $/B/D*	506	605	700	1,150	1,263
Plant	simple	....	.... some lubes		complete
Labor cost, ct./bbl.†	30.8	26.5	25.3	29.8	33.0
Invest. cost, ct./bbl.*	5.5	6.1	7.8	12.6	13.8
Crude and product adjustment, ct./bbl.‡	12.0	6.0	9.0	2.0	....
Costs, ct./bbl.	48.3	38.6	42.1	44.4	46.8
Profit, ct./bbl.§	25.0	34.7	31.2	28.9	26.5
Profit, % of investment‖	13.5	15.6	12.2	6.9	5.75

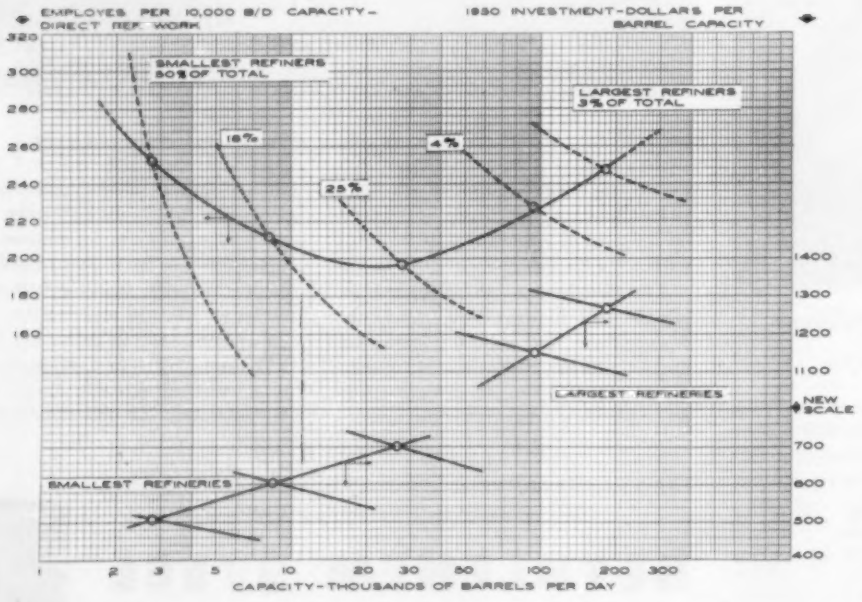
*Average cost of Costimating Series for 8,150 and 93,500 B/D plants. Others reduced 15% (smallest) and raised 15% (28,000 and 183,180-B/D plants).

†Smallest refiners charged with only 10% extra for burdens, but largest refiners 20%.

‡Crude oil is obtained most cheaply by the largest (10 ct./bbl.) and the smallest refiners (5 ct./bbl.). The value of the products from large refineries are worth about 21 cents per barrel more than the products from small refineries.

§Set arbitrarily for purposes of comparison at 25 cents per barrel for the smallest refineries. Notice that this so-called profit must pay for improvements, necessary capacity increases, and obsolescence.

‖This indicates an average profit on investment of 9.55%. This so-called profit must pay for improvements, necessary capacity increases, and obsolescence.



NUMBER OF EMPLOYES and approximate investment per barrel of capacity, for various sizes of 1950 refineries. Fig. 1.

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necessary that the major process equipment (usually the cracking plant) be large enough to be operated cheaply and, of course, the process equipment that feeds the major equipment must be adequately large, and the processes that handle the products from the major process equipment must also be of economical size. Such an analysis results in rather small capacities. Thus a 10,000-bbl. per day catalytic cracking unit is large enough to be operated effectively; it produces enough olefin gases to supply an economical size of alkylation plant; and it calls for a crude oil capacity of only 18,000-27,000 bbl. per day. During 1950 (the date of the data of Fig. 1) even smaller refinery sizes were effective because alkylation was not feasible and because small thermal cracking plants (3,000 bbl. per day) could be used in many refineries. This resulted during 1950 in economical refinery sizes of 5,000 to 12,000 bbl. per day.

One might believe that a larger size of major process equipment would justify a larger refinery capacity and to some extent such a contention is justified. However, management then encounters the danger of becoming a major or large-company management that tends to destroy the advantage of larger capacity. If the psychology of small (or independent) management can be maintained, then a larger refinery capacity becomes highly profitable and the most effective refineries that are known to this department are ones in the 40,000 to 70,000-bbl. per day range of capacity that have been able to maintain a small-operator type of management.

Fig. 1 shows the actual number of employes (workmen) used by the 343 refineries of the year 1950. It is believed that the same general relationship applies to nonproductive employes except that small refiners will exhibit even a greater advantage. Also shown in Fig. 1 is the approximate investment per barrel of capacity. Most of the high investment cost of the large refiners is due to the complexity of the larger refineries. This is not altogether a disadvantage because the value of the products made in the large refineries is larger than the value of the products made in small refineries. However, large refiners also pay more for installations than do small refiners even though the less-expensive equipment serves exactly the same purpose.

All of these effects may be summarized in terms of profitability as in Table 1. This shows a sharp peak in profit for 1950 refineries at a capacity of about 7,000 bbl. per day. Although Table 1 is useful as a means of determining the refinery size of greatest profitability, the numerical value of the various cost items shown in Table 1 are not of much significance.

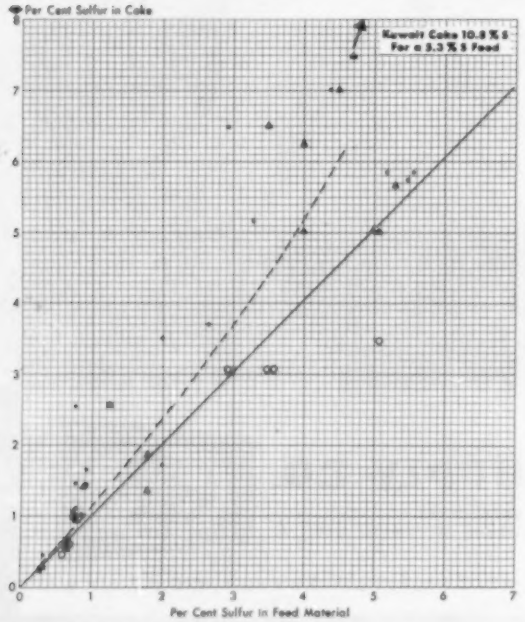
Power for in-tank mixing

Is there technical information on the calculation of "side-entering-mixers" for crude oil tanks with graphs for determining the power required? —R. B.

There are so many possible impeller and nozzle designs that general charts of power requirements are not possible. Manufacturers can provide such charts or information about their equipments. Power requirements are intimately related to viscosity and to the time selected for the mixing. The literature on mixing is enormous and hence only the following can be listed:

1. Serner, H. E., Effective Radius of Agitation . . ., Chem. Eng., April 1950, p. 128.
2. Rushton, J. H., Mixers for Large Tank Blending, Pet. Refiner, August 1954, p. 101.
3. Wilson, N. G., In-Tank Mixing of Crude Oil, The Oil and Gas Journal, Nov. 8, 1954, p. 165.
4. (Refiners Notebook) How to Design In-Tank Jet-Mixing Systems (A series of more than 13 pages), The Oil and Gas Journal, Sept. 6, 1954, through Jan. 10, 1955.

Sulfur in coke vs. sulfur in parent crude oil



RELATIONSHIP between percentage of sulfur in feed material and in coke. Fig. 1.

Have you published anything on the sulfur content of refinery cokes? Does the coke contain much more sulfur than the feed material? W.P.F.

Coke usually contains more sulfur than the feed material but great variations occur. On Fig. 1, the 45° line is for cokes of the same sulfur content as the feed. Most points lie above the line, somewhat as the average dash line, indicating larger amounts of sulfur in the coke. Experimental data are shown with triangles, and West Texas and California oils by circles, whereas data that required an estimate of the sulfur content of the feed material are shown as plain points (dots). West Texas and California sulfur compounds are thought to be thermally less stable than the compounds in other oils and hence one might expect a lower sulfur content in cokes from these crude oils. Likewise Middle East and Venezuelan sulfur compounds are thought to be more stable than those of other oils and one would expect high-sulfur cokes from such oils. Thus Kuwait coke from a 5.3% feed contains 10.8% sulfur.

This same subject was discussed in the March 9, 1953, issue of The Oil and Gas Journal, page 125.

$$* E = \tfrac{1}{2}\,(m_1 v_1^2 + m_2 v_2^2 + m_3 v_3^2) = \tfrac{1}{2}\, M_r v_r^2$$

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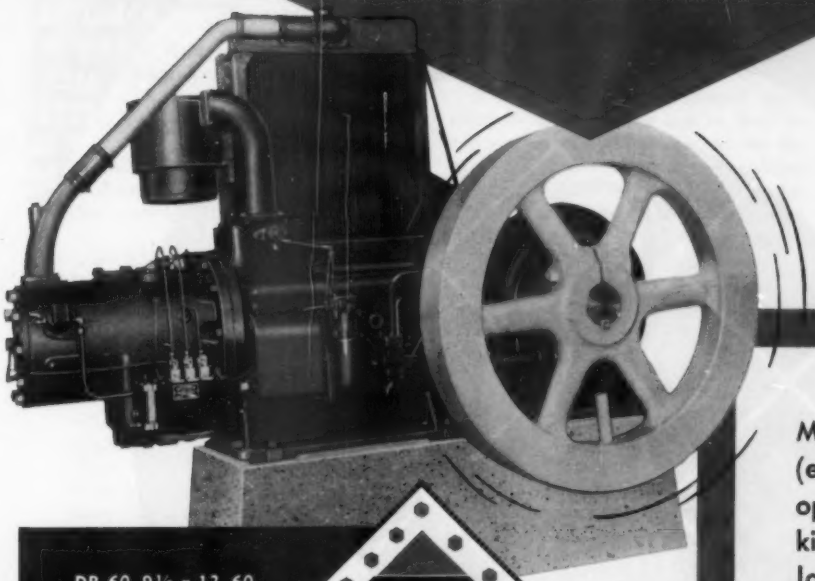

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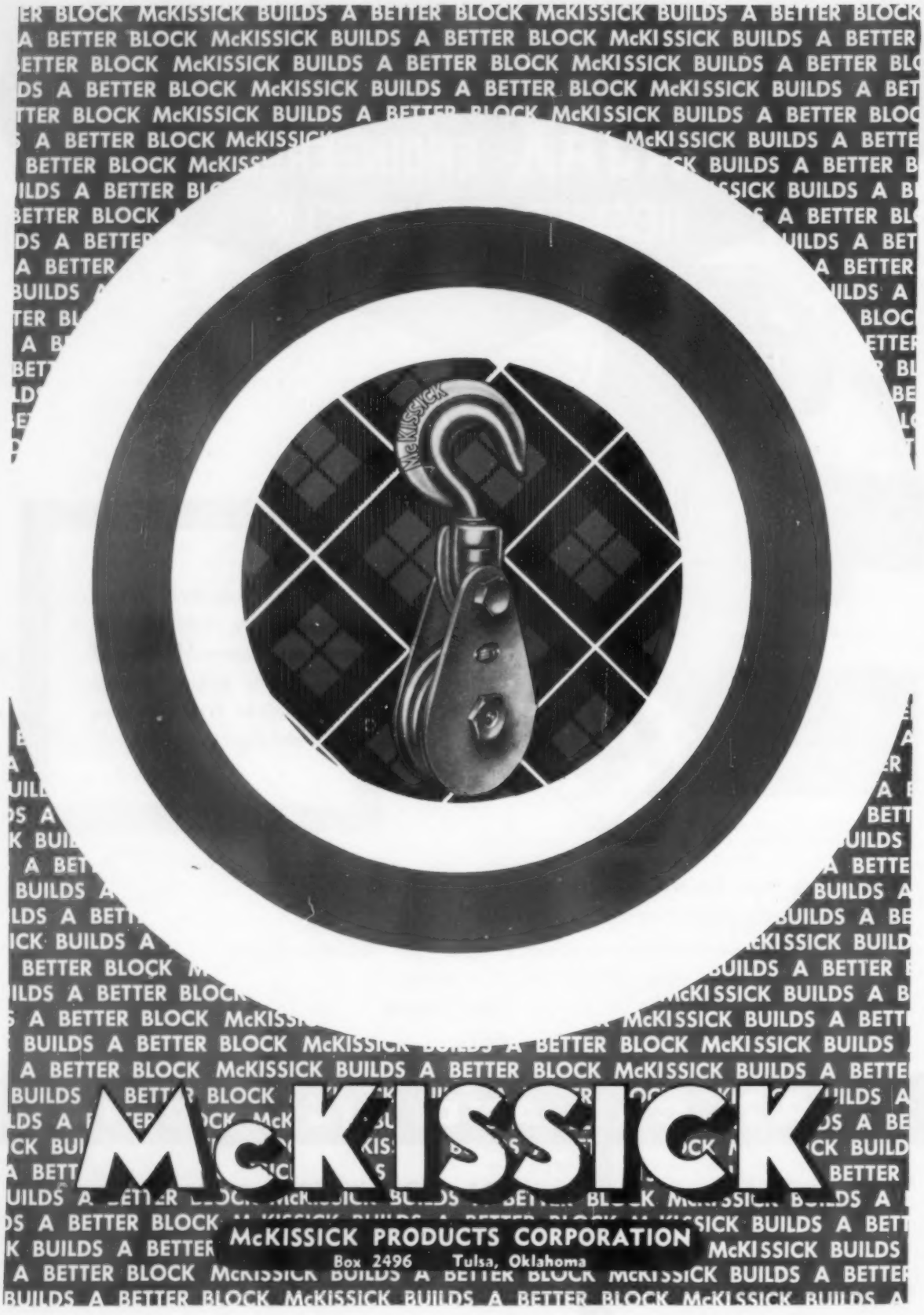

McKISSICK

McKISSICK PRODUCTS CORPORATION

Box 2496 Tulsa, Oklahoma

El Dorado question-answer session on CAT CRACKING

This is the concluding portion of this series. Other installments appeared as follows:

1. **Cat Reforming—February 23.**
2. **Maintenance—March 2.**
3. **Coking—March 9.**
4. **—Alkylation.—March 16.**

BANKS: Does anyone have an O_2 analyzer on a FCC unit regenerator that works? How?

BRANNIN (Cities Service Oil Co. Ponca City, Okla.): We have a Hays oxygen analyzer on our cat cracker and we haven't had any amount of excessive trouble. It took our instrument men a little while to learn the peculiarities of the instrument. One difficulty we've had over the past 5 years is a little trouble due to sampling. We installed a good ceramic filter to take any traces of catalyst from the samples and we now consider this essential. It's just a conventional Hays analyzer. It doesn't give more trouble than any other instrument and we find it's especially valuable in upsets.

ADAMS (D-X Sunray Oil Co., Tulsa): I've seen a number of Hays analyzers that work satisfactorily as soon as the instrument men learn to handle them. They are one of the most reliable instruments of this type. The main problem when they won't work is that you don't have any oxygen to measure, not that the instrument itself is failing.

BANKS: Has anyone used monoethanolamine for H_2S removal from refinery gases in liquids from cat and thermal crackers? What were the results?

MATTIX: We use DEA on our propylene streams. We do not use monoethanol.

ALEXANDER (International Refineries, Inc., Wrenshall, Minn.): Great Northern Oil at St. Paul is using MEA on a C_3-C_4 liquid extraction of H_2S with good success. It is a common amine system on a desulfurizer recycle gas, total fuel gas, and a poly feed. I might add that's a TCC unit and Socony claims they don't make any carbonyl sulfide in those units. That is apparently how they can get away with using the MEA.

BANKS: In a heat-balanced fluid catalytic cracker what can be done to reduce the carbon content of the regenerated catalyst from an existing level of 0.7-0.8 wt.%? The flue-gas oxygen content averages 0.4-0.6% and the dense-phase temperature ranges from 1,080° F. to 1,150° F.

DANIEL: There are quite a number of things that could be done here. The first one would be to cut out any torch-oil usage in normal operation. A second might be to go to a higher pore-volume catalyst. In this case you would have a catalyst that is inherently a little more resistant to sintering and thus maintain better regeneration. Another thing to look at would be the fineness of the catalyst, particularly on the tail end. If you have over 25% on 200-mesh material, this is a good thing to try to reduce. A fourth item would be high regenerator temperatures, giving catalyst sintering.

The question specifies a maximum of 1,150° F. A few people may have found, as we have, that the temperature at one point in the regenerator isn't necessarily the temperature all over. The other side may run 50° hotter. One of our units had to hold temperatures down well under 1,150° F. to maintain activity and good regeneration. Other people say they had good operation up to 1,200° F. on the dense bed, but it's something that seems to be a peculiarity of the unit.

The last thing that could be suggested and certainly not the least is to look at the catalyst elutriation. This is where you have a good amount of either coarse or sintered catalyst. An elutriator will take out both. The type of elutriator I'm talking about is similar to one we've had in operation for about 4 years with good success. It amounts to a 12-in. pipe with about a half-dozen baffles in it and the air is put in the bottom to give the classification. The total installed cost of the gadget with flow controllers on the air runs about $8,000.

THE PANEL

W. L. BANKS, Moderator
WPRA Technical Director
Tulsa

GEORGE JANDACEK
D-X Sunray Oil Co.
Tulsa

O. J. WEBB
Stratford Engineering Corp.
Kansas City, Mo.

E. D. MATTIX
Cities Service Refining Corp.
Lake Charles, La.

E. H. McGREW
National Aluminate Corp.
Chicago

W. K. DANIEL
Standard Oil Co. (Ohio)
Cleveland

GEORGE F. KLINE
Blaw-Knox Co.
Pittsburgh

W. L. HOUSTON
Phillips Petroleum Co.
Sweeny, Tex.

WALTER COSINUKE
Catalytic Construction Co.
Philadelphia

GORDON KERNS
Vickers Petroleum Co.
Potwin, Kans.

WILLIAM T. MADDOCK
Ohio Oil Co.
Findlay, Ohio

The bottoms from the elutriator normally contain about half the amount of —325-mesh and —270-mesh material that we have in the equilibrium catalyst. You can see that isn't a fancy separation, but it's a definite improvement. You only throw away half as much catalyst in maintaining catalyst quality. When we're putting a good amount of air in the bottom of the elutriator and only taking out a small amount of catalyst, perhaps 200-300 lb. a day, that material will run four to five activity numbers lower than our equilibrium catalyst and the sintering indexes are higher than our equilibrium catalyst.

HOUSTON: One suggestion is that if you have enough room left in disengaging height, you could consider increasing the level of catalyst in the

regenerator to bring your carbon level down.

JANDACEK: This sounds as if it might be a problem in air distribution; there might be something awry on the inside of the regenerator. Consideration might be given to adding a preheat furnace to the unit to increase the residence time in the regenerator.

BANKS: In a fluid catalytic cracker does a high (i.e. in the range of 0.82 to 0.86 grams per cc.) ABD (apparent bulk density) adversely affect catalyst fluidity? The catalyst contains 8-10% smaller than 40 μ and 12-16% larger than 80 μ.

HOUSTON: Particle-size distribution of equilibrium catalyst is probably the most important factor that you have to consider in a fluidized system. Experience in a number of units has disclosed that the proper particle-size distribution must be maintained if you are going to get good fluidity. An accumulation of coarse materials can cause poor circulation. This has happened to some units that have started the practice of discarding Cottrell fines in preference to system catalyst. It is essential for good catalyst circulation that a certain amount of fines be present in the unit either from the new catalyst or from attrition of the equilibrium catalyst.

In looking at particle-size distribution and weighing it, the coarseness index is sometimes used. This coarseness index is the plus-80 μ fraction divided by the 40-minus μ fraction. The coarseness index for good fluidity on any given unit depends on the individual unit. On one of our units we had very severe fluidization troubles when the coarseness index was increased above 1.5. This was dropped back through change in particle size in catalyst additions to where the coarseness index dropped below one; we obtained good fluidity.

Now the catalyst mentioned in this question has coarseness index of 1.5 to 1.6, which could easily be excessive for this unit. An increase in catalyst fraction below 40 μ should help. One way to get into the trouble of increasing coarseness index by losing your fines is damage to your catalyst-recovery system. Whether it be cyclones or Cottrell, any damage to your catalyst-recovery system will result in high stack losses of the fine-catalyst fraction; that raises the coarseness index and can throw you into fluidity problems.

McGREW: There are many units experiencing quite satisfactory operation with this particle-size distribution. We should keep in mind that fluidity is not only influenced by particle size but by catalyst density as well. This particular catalyst is getting up into the higher range as far as density is concerned. In this range the difference between 0.82 and 0.86 is quite marked. Can anyone tell me if this is a unit with a Cottrell? Whose unit is this?

ALEXANDER: That's International's at Wrenshall. It's a Model IV with two-stage cyclones on its regenerator.

McGREW (National Aluminate Corp., Chicago): Well, on that basis I'd say that your particle size isn't too bad, but I'd certainly do something to get that density down.

ALEXANDER: What do you suggest?

McGREW: I'd suggest using a more stable catalyst. If your fresh catalyst is low in pore volume, go to a higher pore volume. High alumina is also more stable and will show less increase in density.

ALEXANDER: We've found that to be the case. We can bring the apparent bulk density in the catalyst down with high alumina, but we can't get it down where we would like to see it.

McGREW: Well, you are continuing to use high alumina and how long have you been adding it?

ALEXANDER: We've been adding the high alumina since spring.

McGREW: And you are still in the 0.82-0.86 class?

ALEXANDER: No. We've got her down where she's about 0.8.

McGREW: Well, it looks as if you are going in the right direction. Is your carbon burning satisfactorily?

ALEXANDER: Our carbon level is 0.7-0.8 on regen cat.

McGREW: That is a little bit on the high side. Aside from the factors already mentioned there is, of course, the possibility that your problem is aggravated by pore distribution through your grid or perhaps an extremely low catalyst residence time in the regenerator.

ALEXANDER: Residence time in our regenerator seldom runs over 4 minutes.

McGREW: Well, that's putting it through pretty fast.

MATTIX: I was wondering if a catalyst elutriator would not help? Remove some of your heavy particles in this particular unit to get the heavy ends out of it to help you get along quicker on the changeover.

ALEXANDER: We're anticipating that and we're in the process of putting connections in on the turnaround right now. We hope that will do the trick for us.

MATTIX: We got into this problem about 5 years ago where we switched from a light-density to a heavy-density catalyst. We got into the type of thing that you are talking about here and we had to put an elutriator in to get back out. We found that the heavy particles—not necessarily the large particles but the heavy particles—had much lower activity. And we had both a burning problem as well as erosion problems attending this condition.

PRICE: (American Petrofina of Texas, Wichita Falls, Tex.): The past question concerned carbon on catalyst. I would like to ask what carbon on catalyst various units are running?

BANKS: At Duncan they run between 0.2-0.3%, 0.3 to 0.4% at Pure, 0.3 to 0.4% at Cities Service at Ponca City and 0.2-0.3% at Ohio Oil.

PRICE: Has anyone experienced a yield advantage when going from 0.7% to 0.4-0.5% carbon on catalyst?

CHAMBERLAIN (Republic Oil Refining Co., Texas City, Tex.): I'll put one on the other end of the numbers of this carbon on catalyst at 0.8%. We've been recently running 0.8% high carbon and we think we have been doing pretty good at the unit running at 0.8%. The reason we're not particularly worried about it is that productwise we can't see a lot of trouble. We still seem to be getting our normal distribution of olefins to saturates—and the only thing we have noticed is a little increase in hydrogen gas coming out of our gas plant.

We were running down in the neighborhood of 0.3% sometime back and all this was brought on because we took the water out of the regenerator. We may be making a little less total amount of C_4 minus off the unit in proportion to gasoline at

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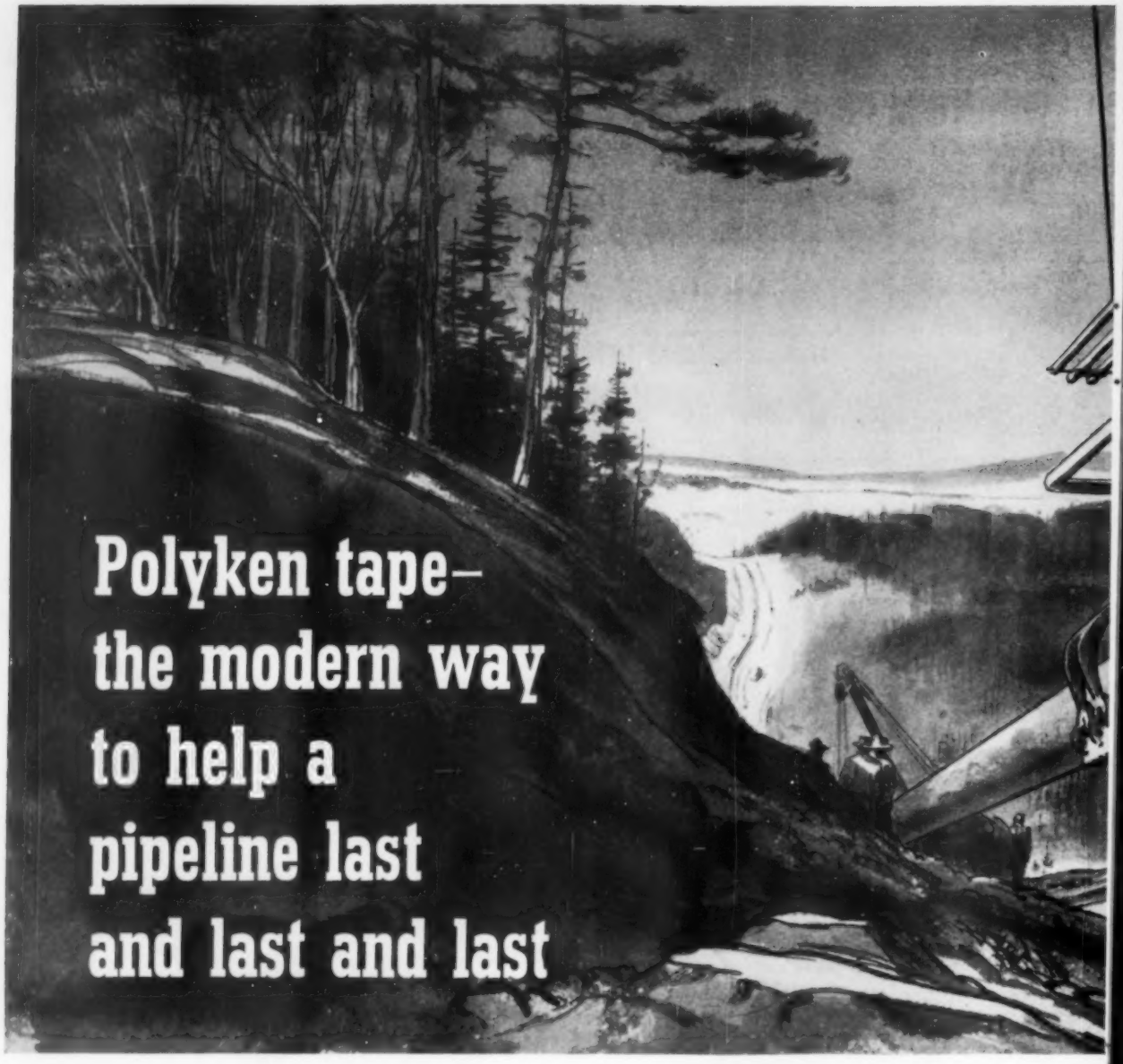

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a given conversion. We move the conversion around so much we can't say for sure.

HICKS (Atlantic Refining Co., Philadelphia): We noted a change when we improved the regeneration of our Atreco unit from about 0.8 to 1.0% carbon down to about 0.2%. We were able to reduce the levels in our reactor very substantially. This was one of the ways we got out of catalyst carryover to the main column. We haven't had much trouble since.

NORRIS (Houdry Process Corp., Philadelphia): We did some basic work some years back on that problem and we found no difference in product distribution or yield for coke on catalyst less than 1.5% residual carbon. You do get an apparent difference in activity with density change as Hicks noted.

PRICE: What sort of regenerator temperatures go with some of these high carbon figures?

CHAMBERLAIN: At Republic lately we have been running a very stable operation to about 1,100° F. on the dense phase. We're not paying a lot of attention to the dense-phase temperature, because we're controlling the temperature above the Buells by running oxygen control. We control that temperature from 1,150° to 1,200° F. normally.

MATTIX: We run up to 1,150° F. in the regenerator bed. We quench below this, going to the cyclones, probably going down to the neighborhood of 1,125° F.

ALEXANDER: We've been running our unit anywhere from 1,090° F. up to as high as 1,180° F. We've pushed the regenerator temperature up by increasing the conversion on the unit. The carbon on the regen cat will come down sometimes as low as 0.5. It is a good indication as to just what sort of residence time you have in the regenerator. The higher your regenerator temperature the lower your circulation rate and the longer she sits in there and burns off. Regenerator level runs about 50 in. water.

BANKS: What is effect of recycle gas-oil initial and 5% points on cat cracking gas yields and quality? Is blocked-out operation on fluid units practiced anywhere? What are results?

MATTIX: The best we can do on this is a comparison between the cracking of light and heavy-cycle stock. At the same operating conditions, the carbon yield on light cycle was 1.18% and 2.15% for heavy-cycle stock. The dry gas was 2.3 wt. per cent on feeds for both stocks. The butylene yield 2.7% on feed for both, the total B-B yields for light-cycle stock was 0.4 volume per cent greater than for heavy cycle stock at constant conversion. The C5 to 430 t.b.p. yield for both cycle stocks was 13.9%. The total liquid recovery, however, was slightly greater for light-cycle stocks than for heavy 98.9% vs. 98.5% which is within limit of accuracy of determination. These were pilot-plant data.

BANKS: What has been the experience of others regarding benefits to be obtained by continuous catalyst addition?

DANIEL: We went to a continuous catalyst-addition system to smooth out unit operation and to increase unit throughput. At one time we had operated by adding a slug of catalyst every 4 to 5 days and to run at a constant conversion we were having to change our reactor temperature through that cycle. Right after we added catalyst we would lower the temperature and allow it to build up through the 5 days to 20° to 25° higher.

At this same time we were limited on our gas-handling capacity. With this procedure the only time we were running wide open on our gas compressor was at the end of the cycle, we weren't using our capacity the rest of the time. By continuously adding catalyst, we kept our gas make more constant from day to day and we could consistently run nearly wide open on the compressor. So that way we wound up with more conversion capacity.

HOUSTON: We've installed a continuous-addition system on two units. The big effect that we've seen is the one that Bill Daniel has mentioned. It eliminated the surge or ripple through the unit caused by batch addition of high-activity catalyst. As to its effect on catalyst losses, we don't have any proof that it affected the loss in any way.

MATTIX: We have both continuous addition and batch addition on two different units. We have run into the high-conversion-low-regenerator effect that Daniel spoke about. At the same time we add a big batch of catalyst; we get overconversion, high carbon on the fresh catalyst, and we think we have a short period of loss at that time. Other than at that particular time, we do not feel that there is a great deal of difference in catalyst loss. We have a smoother-running unit, however, with continuous addition.

JANDACEK: We have continuous catalyst addition on both units and agree with most of the benefits that have been stated. We have a much better control over the quantity of catalyst added.

McFATTER (Cities Service Refining Corp., Lake Charles, La.): We agree with the other arguments on the continuous addition into the dense phase. We have found that you have the fines being added continuously and the fines are present in the bed for a longer length of time to give you the necessary lubrication. We've tried several methods of continuous addition in our units. One of them has been additions with the fresh feeds directly into the reactor. This method was never very successful. Stack losses were quite high at the time and we felt they were partly due to the high-activity catalyst being charged directly into the oil feed.

FERRELL (Atlantic Refining Co., Philadelphia): Would the panel members comment on how the catalyst was added continuously — the physical method of adding the catalyst?

DANIEL: In our case, most of the catalyst is added through a liquid slurry system. The slurry system is used because of prior use of the catalyst in lube contacting. This is just a convenient way of handling. The remaining catalyst is added on the unit, just letting it drop through a sight glass to see that it is carrying in with the air. We've tried our best to determine if there is any difference in catalyst losses between the two addition methods and so far we haven't been able to pick out any.

FERRELL: Does anyone have a way of measuring rate of flow as it's going in?

O'DELL (The Ohio Oil Co., Robinson, Ill.): We use a method with a 1-in. line. We use a regular 1-in. valve with a hole in the dart and keep pressure on the catalyst hopper. We shut the hopper down about twice a week and measure to see how much has been going in. The ⅛-in. dart will put in about a ton a day and we can go to a ¼-in. dart and change back and forth.

EPPARD (D-X Sunray Oil Co.,

Duncan, Okla.): We use a star feeder to add our catalyst. The catalyst drops down out of the hopper in a 3-in. line tied into this star feed. We set the r.p.m. on the feeder to control our catalyst-addition rate. It is no problem to add two or three tons a day. The catalyst from the star feed drops into an air stream and is carried into the riser to the regenerator.

MATTIX: We seem to have gone at this problem in a little different way. We have put in a carrying line with two taps for a differential-pressure meter. There is a constant flow rate of air; the differential meter then adds the catalyst to load the differential between these two taps, which gives us constant flow. This has worked quite successfully.

EPPARD: We tried the same thing, but we had little success. We didn't have a high enough lift to get a good differential measurement. This star feeder is by far the simplest thing that we've found and catalyst addition is no longer a problem.

BRANNIN: We've found the same advantage as the others have on getting the catalyst in continuously. I'd like to mention that the system we have is very simple and works well. We have a line out of the bottom of our hopper that goes through a 2-in. diameter sight glass, 6 or 8 in. long. This drops into a 1-in. line that goes into our regenerator. We add about a ton of catalyst per shift and it takes the operators a couple of hours to do that. They seldom miss more than 0.1-0.2 ton. By just watching the flow of catalyst through the sight glass they can tell how fast it's going.

We ran quite a study on the effect of putting catalyst in the reactor with fresh feed. We set up a special slurry system and added our catalyst just above the reactor grid. We hoped that by getting it into the reactor first that it would contact the oil there and we would be getting more use out of it and might possibly have less losses. We checked it out very thoroughly and we found absolutely no difference.

BANKS: Has it ever been conclusively proved that different cracking catalysts have appreciably different susceptibilities to metal poisoning?

McGREW: It hasn't been conclusively proved as far as I'm concerned. There has been considerable discussion over the past few years regarding the susceptibility of various catalysts to metal poisoning. When high alumina first came out, there were many people who thought that it would be a partial cure to some of the metal problems. This hope was perhaps based on the difference in behavior of metals on alumina and silica as separate materials. But that isn't what you have in cracking catalyst and I haven't seen any data which say that high alumina is any different from low alumina. The metals that are currently coming in the unit are often the worst actors and the catalyst has no control over that.

BANKS: What and how much is the effect of the loss of the 0-40 μ-size particles on: (a) activity, (b) fluidity, (c) product distribution, and (d) regeneration?

MATTIX: We have run into regeneration trouble in running out of fines in catalyst. The oxygen in flue gas went up, which makes for bad afterburning. We theorized the regenerator was rat-holing, couldn't fluidize properly. This was when we put the elutriator on to change catalyst properties. We have since gone to two-stage cyclones and kept our precipitator and have no more trouble. This is something that is a balance between purchases of catalyst and your recovery system.

HOUSTON: We would probably grade these in something of this order in our estimation: Activity would be hurt little; fluidity would definitely be hurt; product distribution would change little; regeneration would probably be hurt due to a loss of fluidity. Regeneration certainly is affected if fluidity is affected.

BANKS: What causes sintering of cat cracking catalyst?

McGREW: The term sintering has several different connotations. It is presumed that this question refers to the pore-closure type of sintering. Laboratory and plant observations both point to high temperatures as being the cause of pore closure. Laboratory work has definitely shown that one must go to very excessive temperatures, in the range above 1,600°-1,700° F., before pore closure occurs. Undoubtedly the same conditions are necessary in a regenerator, although such temperatures are never observed. The only situation one can imagine that would allow temperatures high enough to cause sintering in a fluid bed would involve a relatively stagnant or poorly mixed zone. Under these conditions, carbonized catalyst could support a runaway burning wave such as might occur in a fixed-bed regenerator. One very serious sintering problem was solved by a simple mechanical change to promote more rapid mixing of spent catalyst as it entered the regenerator.

BANKS: What about the effect of sintered catalyst on cat cracker operations and product distribution?

KERNS: One observation in synthetic pelleted catalyst is that at low activities from thermal deactivation in overheated kiln operation, you get a very normal production distribution with regard to coke and an exceedingly low gas-production factor. On 10 activity catalyst, gas factors ran as low as 0.2 to 0.4 relative to normal product distribution, normal being steam thermal deactivation.

MATTIX: I wanted to ask a question on sintering. I had heard about salts acting as a flux on catalyst and reducing the temperature at which sintering occurred, particularly sodium.

McGREW: We tried a number of sodium salts and found their effectiveness in the promotion of sintering to vary with their melting points. Although sodium salts definitely reduce the temperature at which sintering occurs, we were unable to achieve sintering below 1,600°-1,700° F. even in the presence of rather large amounts of sodium. In the units where we have observed serious sintering, it did not appear that sodium was a major contributing factor.

BANKS: In FCCU's, what difficulties, if any, have been encountered when the type of makeup catalyst has been changed—say, changing from synthetic to clay or vice versa?

HOUSTON: On our cat units we have changed catalyst makeup from natural to synthetic and we have experienced no difficulties. In one unit we changed the equilibrium catalyst from 100% natural to a 100% of synthetic and then back to a mixture of synthetic and natural. The catalyst fluidity, recovery, erosion, etc., show no change. The regenerator-bed temperature was increased as the percentage of synthetic was increased, from 1,075° to 1,110° F. to use the improved regeneration characteristics of the synthetic catalyst. Of course, CO_2/CO ratio declined and we were confronted with exercising more care to prevent afterburning. The main difference we found was control of afterburning. We did experience afterburning and some cyclone damage. Provisions were made to introduce purge stream into the dead space at the top of the regenerator, above the

inlet to the Buells. This being a dead space, afterburning was experienced in that area. The excess oxygen content in the flue gas at these higher temperatures should not be above 0.5%. During changes in catalyst, watch the particle-size distribution to stay out of any fluidity problem. Any damage to the Buells from afterburning causes loss of catalyst fines and you can run headlong into a fluidity problem.

MATTIX: We have changed catalyst from synthetic to 40-50% natural. We ran into no trouble in changing over, as far as one type of catalyst to the other. I would suggest watching the basic density of the two catalysts because it will affect the unit, in both erosion and operation. The density effect is the one to watch in this case, and not the type of catalyst.

JANDACEK: The West Tulsa unit was switched from natural to synthetic catalyst. I know of no operating difficulties that were encountered.

BANKS: Has anyone had any experience which would indicate a greater production of phenols in cat naphthas using natural catalyst rather than synthetic?

HOUSTON: We weren't particularly looking for this when we made these changes of catalyst on this one particular unit. The only thing we can say is that we have noted no such increase. We weren't watching for an increase, but looking at phenol content in caustic in our washer, we have noted no such increase.

BANKS: What is the relative degree of erosion in catalytic cracking units using natural catalyst vs. synthetic catalyst?

HOUSTON: We ran one unit with this change in catalyst and inspection of the unit indicated no difference in the erosion.

MATTIX: We do think that we find the difference in erosion—not due to whether it's natural or synthetic, but due to the density. The density of natural catalyst is greater than the synthetic catalyst we're purchasing. We believe there is an erosion difference of 3 on natural and 2 on the synthetic that we are running, due to the density.

BRANNIN: What is the feeling on erosion rate after erosion patterns have been set up? Do you feel that erosion proceeds faster after you have an erosion pattern set up, or is it just a constant rate, a function of time? Every now and then you'll check something and say, 'Well, this has been operating for 2 years and now it's a third gone.' Can it run another 2 years and be two-thirds gone? Or will everything go to pot in the next year as though a pattern had already been set up?

MATTIX: I would think this would be a constant, unless you have changed some condition in one place to cause this to occur. Increasing the velocities in one particular place is the factor we go on. Erosion is proportional to the cube of velocity.

BANKS: Are there any suggestions on stopping sticking trouble on double-slide-type flue-gas-control valves?

MATTIX: We found this to be similar to the problem on sticking of pumps. The manufacturer builds them to very close tolerances and after the machinists have machined them down to about 20-30 thousandths clearance, you have no more trouble. We find our stack slide valves about the same. We have to keep a fair clearance on them to keep them from sticking.

MADDOCK: We had some slide valves that stuck early in our life on our cat cracker. It wasn't exactly this one, but we found that our clearances were in the order of about 9 to 12 thousandths and so we just increased those clearances to about 15 to 20 thousandths and we haven't had any trouble since.

COSINUKE: There are two units in particular that I know about. They added a purge in the bonnet of the slide valve. Before this, the actual clearance became plugged with catalyst from the carryover, which affected the operations.

BANKS: Has anyone had experience with flapper valves on cyclone diplegs sticking open or closed? If so, what was the cause and correction?

MADDOCK: We had flapper valves on our regenerator to stick in the early part of our first run. They had mechanical linkage to extend through the shell of the vessel. We thought that it was due principally to differential in expansion and perhaps a slight bit to misalignment. We removed the flappers and the handles and extended the diplegs down into the catalyst bed. We have about 4 ft. of catalyst above the dipleg in the regenerator and have about 2 ft. above the dipleg in the reactor.

ALEXANDER: On those diplegs where you took the flapper valves, or trickle valves, off, do you have a deflection plate mounted below the end of the dipleg? A target plate or distributor plate?

MADDOCK: We have a hole through the top grid, but there is no deflection plate as such.

ALEXANDER: At the bottom of your dipleg?

MADDOCK: No. We do get moderate losses on the startup. The obvious thing is to load rapidly to get them covered up as quickly as possible.

ALEXANDER: I might add that we had lost the deflector plates on the bottom of our primary diplegs on this past run. We can pin down within 2 or 3 days just when that took place by our losses. It just jumped right up.

MADDOCK: Do you have adequate seal over those diplegs now?

ALEXANDER: Yes, they are sealed by about 6 ft. of catalyst bed.

MATTIX: Where we have no trickle valve, we put in the baffle plate. We had trickle valves to eliminate the losses on startup. We do not have any external mechanism and we haven't had any trouble with trickle valves sticking. We do not believe there should be any external mechanism to complicate the matter.

BANKS: What preventive measures can be taken for erosion which occurs on the upper side of the spent or regenerated catalyst-carrier lines—just downstream of catalyst-injection points?

COSINUKE: This is basically a mechanical problem but design has a lot to do with it. This problem can be solved by the old sugar-scoop deflector plate. This directs the flow of the catalyst coming down into the midstream section and creates less turbulence and impingement on the upper side. A unit started in 1948 had this problem. A deflector plate was installed in 1949 and there hasn't been a problem since.

HOUSTON: We have studied this problem of erosion in spent-catalyst tee sections in scale models and have compared types of injection points on our different units. We feel that the answer to erosion is to lower the velocity of the air-catalyst mixture in

contact with the walls of the pipe. This can be done in two ways, or in a combination of these two ways. One is to increase the size of the air-entry piping ahead of the injection of the catalyst.

Many times these feed tee sections are swedged sections where you have a high-velocity air stream which is swedged out to reduce velocity in a very short length. One thing that did help in this scale-model study was to redesign the air-entry piping, especially the tee to reduce the velocity of the air before it comes in contact with the catalyst.

There is no reason why the air velocity upstream of the catalyst cannot be reduced to the same velocity that is downstream of the catalyst-injection point. We found one other important factor in these studies and that is turning the catalyst flow so that it does not contact the pipe walls until the increase in flow area has reduced the air velocity.

Another alternate would be to put an internal ell into your catalyst-injection point so that you deflect the flow of the catalyst and put it into the center of the flowing air stream. We find this internal ell to be a great factor in reducing the corrosion at these points. You can't reduce it to the point where you can leave out your refractory lining or hex-steel. These two points were of great help in these studies: reducing the air-entry velocity in this swedged section, or changing the direction of flow of the catalyst. We find the internal ell to be quite an improvement.

MATTIX: Since we have put in a device for changing the direction of catalyst (rather than hitting at 90° to the air stream) to turn the catalyst to flowing the same direction, we are able to make a 3-year run without repair to the line.

BANKS: What is the effect of feed preheat variation on coke production at a fluid catalytic cracking unit?

MATTIX: The effect of preheat, as we see it, is the reduction of the amount of catalyst circulated, which improves the stripping efficiency in a cat cracker. Stripping factors that we have encountered range from 0.03 to 0.10. This factor multiplied by the cat-to-oil ratio gives you strippable coke as a weight per cent of total feed. We added a 60,000,000-B.t.u. furnace to one of our units to increase the feed rate. Coke was reduced about 0.6 wt. % from 4.6% when this was added and increased conversion about 2% on the feed.

HOUSTON: One of the best treatises I've seen on this subject is a paper by the late J. W. Moorman published in the January 10, 1955, issue of The Oil and Gas Journal, which clearly shows that the increase in feed preheat temperature will definitely reduce the carbon laydown in the regenerator. Data are included on commercial units on both synthetic and natural catalysts. Experience in our units, which incidentally are all units with catalyst coolers, pretty well parallels this experience reported by Moorman.

BRANNIN: We put a preheater on our heat-balance cat cracker about a year or year and a half ago. We increased the temperature of the feed from about 300° F. up to approximately 725° F. There haven't been any problems at all in maintaining heat balance. There isn't any measurable difference in the temperature of the regenerator, and you can calculate how much coke reduction you'd have to have for so many B.t.u.'s of heat you're putting in the unit. It balances out that way. It also parallels this article that Joe Moorman wrote. A lot of people who have heat-balance units worry about, "Where's all that heat going to go?" It hasn't turned out to be a problem and we have had a coke reduction in a range of 10 to 15%.

DOYLE (Ingram Oil & Refining Co., Chalmette, La.): We added feed preheat during the past run and we've made the same observations that have been mentioned. One additional observation was that stack losses were reduced, as indicated by puffing as well as hopper inventories. Apparently, in lowering the circulation, we have cut attrition and the puffing is reduced even at higher air rates.

BANKS: Was there any change in particle-size distribution that you could tell?

DOYLE: No. It stayed pretty much the same. We have a little bit less fines, but in general we haven't changed our distribution over-all.

BANKS: What's considered to be the maximum desirable operating temperature for carbon-steel cyclones in a fluid catalytic cracking regenerator with refractory lines, cyclone bowls, and dust bins to produce a minimum life of 4 years?

JANDACEK: Our Duncan unit is running between 1,180°-1,190° F. and the Tulsa unit is running about 1,200° F., sometimes 1,220° F. We expect 4 years' life. Those are dense-phase temperatures and the temperatures above the cyclone are not much different and may be a little bit higher. The outlet of our cyclones at Duncan run between 1,200° and 1,250° F. I would say it probably averages about 1,220° F. A recent 15-day average from West Tulsa unit shows the regenerator temperature above the grid to be 1,228° F. and the regenerator top 1,222° F.

MATTIX: This would depend somewhat upon the oxygen left in the flue gas. If you have good regeneration, very good contact in the regenerator and can get your oxygen down low, then you'll have very little oxidation on the cyclones. If you had 2 to 3% O_2, then I would expect trouble at rather low temperatures. We run 1,125° F. at low oxygen concentrations and we do not expect trouble in 4 years.

COSINUKE: The limitation that some of the design companies talk about is 1,200° F. We ran into a little bit of a problem in a cyclone after 5 years in service. They start off about 1,100° F. and at the end of the fifth year at a 1,200° F. range, oxidation from the flue gas started to react on the carbon steel.

ADAMS: We can expect these cyclones to eventually fail from external oxidation. They're internally lined, but when you operate at that kind of bed temperature you have little or no excess oxygen at the cyclone level unless you've got poor air distribution in the regenerator. Our life experience to date has been pretty good. Of course, the supporting members for these cyclones are not carbon steel; they are chrome alloy.

BANKS: What are the merits of the use of regenerator spray water for cooling in a fluid catalytic cracking unit above and/or below the dense-phase level? What are the effects of spray-water composition on catalyst-activity maintenance, attrition, and sintering index?

MATTIX: Spray water is used, as far as we are concerned, mainly to protect the cyclones from afterburning. The spray water should be above the bed and not actually in the regenerator bed. If we are to figure on removing heat from the regenerator bed, we would expect to produce steam from this and put coils in the regenerator.

JANDACEK: Both the Duncan and the Tulsa units are running with dense-

phase temperatures between 1,180° and 1,220° F. We don't use spray water but operate with controlled afterburning.

HOUSTON: Our feeling pretty well parallels that of George Jandacek. We feel it is best to use the quench water only as an emergency means of controlling afterburning and not as a continuous measure. We had definite trouble with attrition of catalyst in one of our units which we attributed to thermal shock as the result of using spray water on a more or less continuing basis. We have also had an occasion to find that the spray-water composition can hurt catalyst activity, especially where it is high in basic constituents such as sodium or calcium. This got to be a very definite factor in operation of one of our units.

EPPARD: We did operate at Duncan for a while with about 30 g.p.m. condensate water spray in above the bed and we never see any serious effects on the catalyst. However, we did damage some cyclones with spray water at one time.

HOUSTON: We would second this comment of Jack Eppard in that condensate makes a very ideal spray for this situation since it does not have these basic constituents that can damage catalysts.

ROSE (Tidewater Oil Co., Delaware City, Del.): In our current shutdown on our cat cracker, we found that these water sprays had broken loose and impinged upon our cyclones and actually breeched them and we are looking for a better way to hold these things down. Does anybody have any suggestions?

BRANNIN: One thing we've done to keep from having erosion on the outside of our cyclones where the sprays have a tendency to whip catalyst around is to put some hex mesh on the cyclones and plaster that over with insulating cement. We haven't had any trouble with warping of cyclones or any places where we had a leak develop. At times we welded plain flat plates on the wear points on the cyclone and covered those plates with insulating cement and hex mesh. We have tried different kinds of waters for spray in our regenerator. We originally used city water; relatively hard water of about 8 to 10 grains hardness. We switched over to condensate and watched it very carefully. After studying the thing through we couldn't tell any significant difference. We actually expected to have better catalyst-activity maintenance and less contamination, but we never did find it made any noticeable difference.

FLOOR COMMENT: Our cat cracker has had normal spray water in it for probably 5 years since startup. We have a set of normal sprays just below the level of cyclone inlets. We have always sprayed condensate at those points. We have a set of emergency sprays to quench any afterburning in the event it should start in spite of normal spray. It takes periodic inspection of these sprays to make sure that you have a good pattern from the spray heads themselves. Our sprays are retractable so that you can take them out of service and pull them back through the wall. We have found that periodically you'll have to replace spray tips because erosion of the catalyst will actually get back into the dead spray and cut the nozzle out. We've had difficulty with our bed-level recorder and found we had a spray that was impinging on the bed level itself, but other than that we've had no difficulties. The last shutdown we put in a third set of cyclones, which necessitated moving the sprays which would have impinged upon those cyclones or hangers.

FERRELL: While you are on the subject of the retractable sprays would you please comment on difficulties experienced with pulling them and what remedies you've found?

FLOOR COMMENT: Occasionally you'll have difficulty pulling a spray barrel. The barrels themselves have a steam connection that bleeds through a restriction orifice that keeps some steam bleeding around the barrel at all times. The line that goes through the refractory is a 2-in. pipe. The spray tip has a centering device on it that keeps it centered in this pipe. The steam that we use for purging this connection is a drilled boss on the regenerator side of the gate valve that is on this spray connection.

We have had difficulty pulling some of these sprays. We have since gone to the boss on the valve body on the outside of the disk because we found that we get catalyst back in at or near the valve body itself through which the spray must be retracted. We've 16 normals and pulled them a number of times in the past 5 years, but we have lost the use of only one spray because of failure to be able to pull it.

MATTIX: I'd like to comment on the use of condensate. In the use of condensate, quite often if we have boilers on cat crackers we will drift into the use of boiler feed-water chemicals and unless piping is changed sometimes we'll be treating our regenerator spray water.

BANKS: Has any refiner made use of testing active alumina content of catalytic cracking catalyst as a means of determining catalyst real activity?

McGREW: I presume that this question stems from a paper given at the San Francisco A.C.S. meeting this past spring which was authored by two gentlemen from Standard Oil Co. of Indiana Laboratories. The method involves the titration of free caustic liberated from the reaction of sodium fluoride on cracking catalyst. Since sodium fluoride will not liberate caustic from alumina alone, it is presumed that it is the combined or active alumina in cracking catalyst which reacts.

The Indiana paper showed rather good correlations relating combined or active alumina with cracking activity. The test is applicable to both fresh and equilibrium catalysts. It must be assumed that, having developed this test, the Indiana laboratories are using it, at least to some extent. Since this is a relatively recent development it is doubtful that other refiners have had very much experience with the method. I do know of one other refiner that has recently started to explore the test.

HICKS: We've tried this in the laboratory. We are still really in the development stage. To date all we can tell is whether we've got fresh catalyst or equilibrium. We can't tell much more than that.

McGREW: At what temperature are you running your titrations?

HICKS: I don't know the details.

McGREW: You'll have to use a different temperature on fresh and equilibrium. The fresh catalyst can be titrated at room temperature. If you're working with equilibrium catalyst, you'll have to go up to about 180° F. Are you using an automatic titrator?

HICKS: I really can't tell you the details. Our laboratory fellows have been doing this. On our Atlantic distillate plus loss (D+L) they can't tell better than ±4 or 5 D+L.

McGREW: The precision on your activity is better than that, I would assume.

BANKS: Are there any data available to correlate catalyst stripping ef-

ficiencies versus reactor temperature and boiling range of catalytic cracking unit fresh feed? What is considered to be good hydrogen content of coke on catalytic cracking catalyst? How may better catalyst stripping be attained?

MATTIX: We have made a number of changes in stripping. We do not have any correlation. As to stripping efficiencies, there are too many factors that enter into it, such as catalyst circulation rates. We have changed our standpipes on the bottom of the strippers to where we can put all of the steam in the standpipe. We have found that the original stripper was about three times as large as necessary in total area, so we have baffled it to reduce the area of it, increasing efficiency of the stripper. As to the hydrogen/carbon ratio, we believe that anything above 10 to 1 is rather poor stripping.

KERNS: We have had at Potwin a serious catalyst-stripping problem on our TCC for over 6 months. We have since solved this by recognizing the fact that there is a limit in boiling range of liquid feed which you cannot exceed without having smoke-plume problems. We haven't measured the quantity of oil in our plume, but as a visible problem we had probably the heaviest plume I have ever seen in any TCC or Houdriflow. We do not have a "plume-burner" in our kiln as some TCC units do.

We now limit ourselves to vacuum gas oil of 1,150° F. e.p. Beyond that, we have a problem that cannot be handled by increasing stripping steam. At about 950° to 1,000° F. e.p. we found 10 to 12 lb. per ton satisfactory. This is all qualitative as we had no measure of our oil contents. At about 1,080° to 1,100° F. e.p. liquid feed, it takes 15 lb. per ton to strip. We now have increased preheat on our liquid feed to 725°-750° F. and at 15 lb. per ton have very satisfactory catalyst stripping.

JANDACEK: We have no correlation between stripping efficiency and the feed-stock characteristics, but we believe that a low hydrogen content of the coke correlates directly with a hot regenerator. As long as I've watched the Tulsa unit, it's been between 8 and 9%. The Duncan unit is now operating between 7 and 8% hydrogen on coke. Back in the days when the Duncan plant ran on 1,100° F. regenerator, the H_2 on coke was up around 10% and since the regenerator has been running hot, the hydrogen has gone down to 7 or 8%. We are using less stripping steam now than we did a couple of years ago.

MATTIX: Doesn't the hot regenerator do the same thing that feed preheat does—reduce cat circulation and reduce strippable material?

JANDACEK: I would imagine so, yes.

MATTIX: As to the boiling range of the feed on fluid cat cracking, we do not find this limiting. We have propane deasphalting, which takes the boiling range as deep as it will go. Our opinion there is that the heavy ends have to be cracked in the stripper to strip them off so volume does have an effect in stripping on heavy hydrocarbon feeds.

NORRIS: One comment with regard to the Houdriflow-type units, we've never found any limit on the amount of heaviness for the heavy feed going into a unit, even units that are essentially 100% liquid. Solution to such a problem is strictly the mechanical matter of contacting oil with enough catalyst at high enough a temperature. This is basically the heat side of cracking and with that properly taken care of we have had neither greater nor less plume at 1,100° or 1,150° F. or even with full Houdresid operations than we have had with running light gas oils in the earlier units.

BANKS: What is the experience in the industry in coking clarified slurry oil with regular coker charge stock and charging the gas oil produced back to the catalytic cracking unit?

JANDACEK: At the Tulsa plant we block operate the coker and coke the decanted oil. At the Duncan refinery we have mixed the decanted oil with the reduced crude feed to the coker so that the coker gas oil in both refineries contains some cracked decanted oil. We have not evaluated this problem. We know we build up a recycle in the system, but crack it all sooner or later.

BANKS: What is the best preheat temperature on the feed to the catalytic cracking unit to get optimum operation on the unit?

DANIEL: Speaking for heat-balance units, maximum feed preheat definitely appears to be the best. This is based on the following reasoning: First, the resulting reduction in coke make will increase the yield of salable liquid product. The reduction in coke make is usually roughly equal to the preheat in B.t.u. per hour. Even if you don't get a corresponding reduction in coke make, then you can use that heat that's left over for a higher recycle operation if your unit will physically handle the recycle. With regard to the effect of recycle on yield, it seems that no matter what recycle ratio you're at, a little higher one would give you better yield picture.

HOUSTON: Bill Daniel pretty well covered the heat-balance unit and it appears that the same benefits would accrue to those units with catalyst coolers.

MATTIX: We would concur with what Daniel has said and might add that the least justification would be taking gasoline out of the cat cracker regenerator and substituting heat through a furnace with fuel gas. That would be the minimum payout you could see on the justification for the feed preheater.

BANKS: Does anyone have any correlations on particle size against activity (that is screen fractions) in a fluid cracking unit?

McGREW: We have separated a number of equilibrium catalysts into various particle-size fractions and determined activity on each fraction. In many cases the coarsest fraction showed the lowest activity. This is perhaps because this fraction would contain a high percentage of old material. Instances have been observed, however, where the finest fraction was the lowest in activity. This may be the result of good fines recovery, with some catalyst withdrawal, and the possibility that the fines are perhaps exposed to the most severe deactivating condition in the regenerator.

KERNS: We've observed octane over a fairly narrow range from 0 to 0.35 recycle ratio and find no significant trend with recycle at the same reactor temperature.

BANKS: Has anyone found an advantage in charging fresh feed directly to the reactor of an FCCU versus going up the riser? Has anyone found an advantage in taking heavy gas oil directly to the reactor?

JANDACEK: We do it at the Tulsa plant. The light gas oil and recycle enter the riser and the heavy gas oil enters the reactor just above the grid and the slurry recycle enters above the bed.

MILLER (D-X Sunray Oil Co., Tulsa): We definitely can tell about the slurry. When we put the slurry up

above the bed instead of in the risers, we get a sharp reduction in coke for a given operation. There were two reasons why we put the heavy gas oil in just above the grid rather than in the risers. One was to reduce the velocity in the riser and reduce erosion and the other was to crack the heavier gas oils at a lower temperature and both of these have proven very advantageous.

McGREW: I can think of some cases where it might be disadvantageous. In some of the postwar stacked-type units, a considerable percentage of the conversion occurs in the riser. For these units there would seem to be little virtue in putting the fresh feed directly into the reactor.

BRANNIN: We've just finished a turnaround and put all the gingerbread in to try both of these things. We hope within another month or two to know the answer. We have an Orthoflow stack-type unit with reactor on top. Canadian Oil Co. in Sarnia, Canada, has a similar unit built from the same blueprints and they have tried it. They tell us that on their trial they found a disadvantage in putting the fresh feed up in the reactor bed, and so they quit it for that reason. They have also tried the heavy gas-oil recycle and it was of questionable value—perhaps a breakeven deal. They did find a disadvantage of putting the fresh feed that way. We're going to try them both ways in about another month or two.

KOPF (Atlantic Refining Co., Philadelphia): I just want to comment on a couple of the last items that have been talked about. One of the questions was on octane. We carried out a pretty fancy study recently while looking at preheat furnaces. If you reduce conversion on total feed by putting in a preheat furnace, the number that we came up with was .05 octanes lost per unit of conversion on total feed. In other words, if you dropped 10 units of total conversion, you would lose a half octane. That was based on a considerable amount of pilot-unit data.

KERNS: Was that at a constant reactor temperature?

KOPF: Yes, sir. This was done pretty carefully, keeping constant those variables which should have been kept constant. The other thing I want to mention is this question of dropping feed into a reactor directly. We have an Orthoflow unit in which that is done. All the feed goes directly into the reactor. The reactor is on the bottom and the feed enters the unit in a series of nozzles around the periphery of the reactor. We believe that this is a poor way of doing it, the reason being that the first catalyst that the oil sees is a high-carbon-level catalyst.

We believe this results in more coke formation than you should get. We proceeded to make some modifications to our Orthoflow unit reactor. We reduced the amount of coke make from about 120% of what it should have been, by our thoughts, to about 110. We haven't been able to do better than that so far. We attribute this fact to dropping oil directly in on what amounts to a spent catalyst.

PRICE: I was just a little curious as to whether D-X Sunray got any drop in conversion when they got that drop in coke make?

MILLER: I don't have any specific figures in mind on that, but coke make was the primary thing that we were after at this point and conversion was relatively constant.

MATTIX: When we put in our feed preheat, we held our conversion constant. We did not drop the conversion.

BANKS: What is considered to be the maximum bottom temperature that can be carried on a cat fractionator without getting into a coking problem? What is the relationship between maximum bottom temperature and conversion level?

HOUSTON: Our experience may not be at the top temperatures, but we have operated units with bottom-tower temperatures from 695° to 700° F. without excessive coking. We have heard of some units that operate up to 710° F. without excessive coking. On the other hand, we hear of some that have excessive coking at 700° F. It seems pretty difficult to pinpoint a figure for a particular unit.

We don't have any specific data on the question regarding bottom temperature and conversion. One could theorize that at the higher conversion you have a more refractory slurry oil in the bottom which would probably not coke quite as readily as a less refractory slurry, so that at the higher conversion one might expect to operate possibly with a little bit higher temperature than at a lower conversion.

ALEXANDER: We have a Model IV unit where we use the combination tower to take the reduced crude off the crude unit, put it into the main column of the cracker and strip the gas oil that way. We use the tray temperature just two trays down from the recycle draw as our cut point. This is not a true recycle since it contains about half virgin material. We found that we can run that as high as 780° F. without excessive coking.

MADDOCK: Our experience is fairly comparable to that of Phillips, cited by Bill Houston. We've operated 700° F. on the tower bottoms for quite a period of time. That was at a 73% conversion and 9° API gravity bottoms and we had no coking problems. We have gone as high as 720° F. for a period of time with no problems.

MATTIX: I would like to comment on that. I've got to go back to almost ancient history in cat cracking to do it. We originally had some hardware in the base of our tower the transfer line came in and turned up. We had excessive coking problems from coke forming on the outside of this line even though it was insulated. Those have been cut off. Since that time we've had no coking problems at all. We got up as high as the temperature needed to produce the quantity of decant oil that we wish to produce. We got down as low as 3.0° API gravity at times.

BANKS: All other things being the same, including activity and reactor bed height, what method of operation gives the best product distribution: (1) high throughput ratio (TPR) and lower reactor temperature or, (2) low TPR and higher reactor temperature?

DANIEL: In the first place, maybe we should say the best product distribution is the product distribution you need at that particular time. Starting from this the main advantages from the higher-temperature low-recycle operation are threefold. One is the higher F-1 leaded octane on your cat distillate, a second one is a higher total C_4 yield, and the third one is a higher unsaturated percentage in your C_4's. By contrast with the higher recycle and lower temperature, you've got three different advantages. One is a higher C_5-plus-distillate yield; two, a lower light-ends (C_4 and lighter) yield; and thirdly, a higher percentage of light cycle in your total cycle oil.

The application of the two operations might be something like this: If you're hard up for octane or if you're reforming in the 93-95 clear level, you'll probably find that your

over-all economics would favor a higher-temperature operation, particularly if you've got some alkylation capacity and reasonably priced isobutane to use up the extra butylene it makes.

A lower-temperature operation would be most applicable if you want gasoline volume more than octane. If you're comparatively loaded in your gas plant, that's the way of minimizing gas make for a given amount of throughput. The higher recycle that goes with the low reactor temperature also makes a very definite change in your cycle split and you'll get a lot more light cycle.

We're now running a unit with a 1.0 recycle ratio at about 65-70% conversion and we're able to get away with only about 2% oil heavier than light cycle. I should point out there, that when people think about high-recycle operations, normally they're thinking first about gasoline yields. If you have a good furnace-oil market, you might make just as much money with a high-recycle operation in making furnace oil rather than heavy fuel.

ADAMS: If you're limited by coke burning or air capacity, you can run at a higher conversion level at high reactor temperature and low recycle because you make less coke for a given conversion under these conditions.

BANKS: In cat cracking, what effect would one get in increasing the superheat on the stripping steam going to the catalyst from the reactor?

KERNS: We have not tried it, but we would expect none. This is one thing that we considered and abandoned in our cat-stripping problem. If you make a heat balance you'll see that it contributes practically nothing to the temperature at the stripping point.

BANKS: How high can you go with hydrogen in the dry gas before: (1) It affects gas-compressor operation adversely, (2) it affects conversion materially?

MATTIX: I think we've run the gamut at Lake Charles on this type of operation. As adversely affecting the gas compressors, you would first have to ask the question, "What type of gas compressor do you have; is it reciprocating or centrifugal?" It will immediately start affecting both of them because it has increased volume. It hits the centrifugal compressor very quickly. We have been as high as 700 cu. ft. and even higher per barrel converted. We do not think this is proper operation. We limit our contaminated unit to a maximum of 250 cu. ft. per bbl. converted. On the other two units we are much lower than this.

BANKS: Has anyone besides D-X Sunray or Frontier installed automatic regenerator air control on an FCC?

DUSSELL (Pure Oil Co., Nederland, Tex.): We're the ones that asked that question because we just finished trying it, and we're not happy. Were you?

JANDACEK: We are very happy with it. We feel that it gives a smoother regenerator operation and keeps us out of carbon buildup very nicely. I was talking to Eppard at lunch time and he said that he can't remember when they've been behind in burning since they've adopted this technique.

DUSSELL: Our problem seems to be mainly the finding of a proper combination of settings on the instrument to keep up with the thing. The operating people that we have running the unit think that we can do a better job under present operating conditions without this instrument. We're having somewhat of a personnel problem in that respect. We're trying to run off a stack temperature. Is that what you use?

JANDACEK: We have a thermocouple in the cyclone outlet. Another refiner that we know of is operating without that instrument. He's operating manually, I don't know if he cares to comment on it or not.

EPPARD: In our refinery, we had trouble with regeneration and George Adams worked very closely with the operators. Then we installed the air control and turned it over to the operators. They worked with it until they got it to working. It wasn't the technical people that made it work, it was the operators. The operators have a number of indicators they use to make this control effective.

ADAMS: If you're going to use this instrument, you've got to accept the principle of letting the afterburning go on continuously and controlling your regeneration air by watching the flue-gas temperature. You can control either by manually changing the air, or with an automatic control. The two installations we have don't control a major portion of the air stream, they only control the trim stream. The operators occasionally have to make manual air adjustments when the instrument begins to get out of limits. The air isn't controlled sharply, it's sort of a drifting control. The temperature may drift around 5°, 10°, 15° within the control range.

DANIELS: On Dussell's (Pure) experiment, were you controlling the trim stream or the main air stream? The full stream. Was your main problem a sluggish control, or overcontrolling, or how would you characterize your trouble?

DUSSELL: We couldn't control from either end, you might say. This experiment was on a full stream. We tried just about every combination of setting on the instrument itself, as far as reset and proportional settings, that were possible. Under one set of instrument settings it would be sluggish, and the automatic air control would not change the air supply in time to prevent excessive afterburn or coke laydown. In the other case it would overcontrol. In no case would a happy medium be obtained. We finally had the operators working with this TRC just as they used to work manually with the original burning air FRC itself. We didn't feel that we were coming out ahead on the situation. Maybe we just haven't given it time, I don't know.

DANIEL: We feel that D-X's success on it is the fact they use the control on a small trim stream. We've got a large 100-M.c.f. per minute blower where one line on the chart is 1 M.c.f. per minute. It was difficult to properly control the afterburning so we've put in a manual trim-stream control such as D-X has and in the very near future we hope to get it on temperature control. This control has been of great value in lining out the regenerator.

DUSSELL: I think our conclusion is the same thing. I don't know if these fellows have tried the full stream or not, but from what I gather, the only out on this is using a trim stream.

ADAMS: Our experience was with using a trim stream.

DUSSELL: Glad to hear that. We can start from there.

MATTIX: I would like to ask one question there of Dussell. What temperature were you trying to run the top of their regenerator at? Were they up in the neighborhood of the 1,200° F. continuous afterburning, or were they trying to control down where the rest of us do?

DUSSELL: Well, our temperatures on the regenerator are running anywhere from 1,150° to 1,180° F.

MATTIX: That is above the cyclone?

DUSSELL: No, that's bed temperature. Our cyclone outlets are normally 1,115°-1,125° F.

CHAMBERLAIN: We don't have a fully instrumented system. The blower is on flow control. We do reset the blower. We can set one-tenth of a division on a 0 to 10 square-root chart. We have that close a reset on the total air. We have an operator between the temperature and the blower reset, but I think we could put an instrument in there. To get into this operator problem, when we started, our operators were all firmly convinced that we could never cut out our spray water and control our temperatures strictly with air. Now the operators are firmly convinced it is the only thing to do. They can control the unit a lot better and everything runs beautifully. It's been a selling job that mostly the operators have done on each other. We like it pretty good.

FERRELL: We are interested in this trim-control idea very much. One problem we're very concerned with is the sales job to operating people. Somebody mentioned the word "stability." Now most of our controls at present work very well using spray water and using cyclone steam. We have ourselves in a good working position; however, our difficulties come about in that we run a constant air rate. We vary feed depending upon its nature. We will get a tank which can run the gamut for a given air rate from 23,000-24,000 bbl. a day to 30,000 bbl. a day at the same air rate. I was curious if the fellows who had been using this trim control have feeds which vary or are they fairly consistent-type of feed stock?

ADAMS: Maybe Joe Miller will have something to add to this. Because of the lube operation in Tulsa and other tankage problems, we have a feed there that varies widely, and in that unit we tend to vary the feed rate with its composition. This trim control on the air is not used to the extent that it is at Duncan. In this case we have a vent control which usually runs closed, but when afterburning tends to pick up it will cut out some of the air. There is a lot more hour-to-hour control exercised on that unit.

MILLER: That's about the state of it in Tulsa. It's not quite as useful on the unit that has to be continuously changed in feed rate.

COSINUKE: On this Pure experiment, did you have turbine control on the blower? Did you cut back on the steam valve to slow down the speed on the blower for the trim air, total air, or just what? You may have had governor troubles, which will happen quite often.

DUSSELL: No, I don't think that's the angle. What we actually have tried to do with the instrument people is hook up a temperature-recording controller, controlled by stack temperature, to work the air-flow flow-recording controller with which we normally handle flow.

COSINUKE: How do you control your main air supply? Vanes on the inlet side of the blower? I don't remember a cat cracker operation, but on similar installation temperature, resetting the flow works beautifully either on vanes or turbine control. We tried many kinds on turbine controls and have found that maintenance problems that occur on the governors create the real problem of control and not the instrumentation.

DUSSELL: We have a pressure control controlling steam to the blower turbine and a flow regulator operating a butterfly valve in the combustion air line. However, I think our whole problem is trying to control too big a volume of air and getting to it in time. I'm still convinced that some combination of the instrument setting ought to be able to pick this up fast enough and we're not doing it.

COSINUKE: Instrumentation will do it. The change of attitude of personnel is just a psychological problem more than anything.

MATTIX: It could be a possibility that one group here is controlling at a much higher temperature than the other and continuous afterburning would exist under the one condition and the other getting down on the low side to where afterburning might not continue.

DOYLE: We obtain good regenerator control using recycle, holding the flue-gas temperature 10°-30° F. below the bed temperature. The air rate is infrequently adjusted to hold the regenerator temperature up to a maximum of 1,175° F. The trimming with recycle is very good except that fairly constant attention must be given by the operator.

BANKS: What has been the experience when increasing the pore volume of fresh catalyst makeup, particularly with respect to catalyst regeneration and consumption?

McGREW: The effect would depend on the base point from which one starts. A low-pore-volume catalyst will have poor stability and will have high density at equilibrium. This high density may result in poor fluidization which will have an adverse effect on regeneration. Starting with a low-pore-volume catalyst, results should improve as pore volume is increased. On the other hand it is possible to get pore volume so high that the attrition characteristics of the catalyst will suffer. One has to compromise between stability and attrition.

MATTIX: We have gone through this and when we started losing out by attrition, we started increasing new-catalyst particle size. We've gone from 40μ average particle size on up to 60. In doing this, we have found that we keep the same volume of catalyst in the regenerator and cut tons of catalyst purchased up to the point to where we dare go in reduced particle density.

BANKS: What effects does high oxygen partial pressure have on regeneration and catalyst deactivation? Is anything known on the magnitude of increased sintering?

HOUSTON: An article by Johnson and Maryland of Sinclair entitled "Carbon Burning Rates of Cracking Catalyst in Fluidized State" was published in Industrial & Engineering Chemistry, January 1955. This seems to be a good treatise of this subject and it is pointed out in this article that the regeneration or carbon-burning rate is proportional to the oxygen partial pressure. We do feel that up to a point increasing the regenerator bed level will accomplish the same thing as far as carbon-burning rate, as will an increase in oxygen partial pressure. In other words, the low burning rate can often be offset by increasing regenerator level. Other things being equal, the high regenerator level will lower the equilibrium carbon on catalyst. We don't have anything on the magnitude of increased sintering.

HICKS: This question was directed at the news recently about tying O_2

plants into cat units and raising the O_2 content of the air. We like the idea, but we're just afraid that if you get very high up in oxygen content you might get some troubles and we were wondering if anybody knew anything about it?

MATTIX: This is being tried at Cities Service in Chicago. They are adding liquid oxygen downstream of a blower and the oxygen content of the air downstream of the blowers is up to 25.5% by weight. The coke burning has gone up directly proportional to the oxygen content. It has not probably gone long enough to be a complete test. So far they have not found anything detrimental.

NORRIS: Based on Houdry basic studies, the only thing that you would expect from burning with higher oxygen concentration is the possibility of flash burning causing sintering. I don't think there is anything else that would concern anyone. We never noted any other kind of difference in quality of catalyst after burning in higher oxygen concentrations.

BANKS: Was there any increase in sintering as the second part of the question asks or not?

NORRIS: We didn't go far enough on that type of thing to have any comment except that we felt it could happen.

MATTIX: We do this same thing in commercial cat cracker practice and don't even worry about it because going up on regenerator pressure does the same thing. It increases burning just the same as increasing oxygen concentration increases burning rates. Two of them are directionally the same. Why are we worried about it? You wouldn't think anything about going to a 30-lb. regenerator if you had a 10-lb. If you had a 10-lb. regenerator and you increased the oxygen concentration, you have the same partial-pressure effect.

HICKS: You've just confirmed that we haven't got as much nitrogen immediately there to take the heat away.

MATTIX: Most of our heat is taken away by the catalyst we bring into and take out of the regenerator or by circulating catalyst.

NORRIS: You know the early Houdry fixed-bed units actually ran low-pressure regeneration before they got on to the regenerative type of turbine unit. They then found the increased partial pressure of oxygen at the 45 to 60-psig. regeneration level very beneficial in increasing the coke-burning rates. This is the same thing precisely as your experiment at East Chicago when you come right down to it. We never had any appreciable sintering of catalyst in the Houdry fixed-bed units.

BANKS: What control techniques can be used to prevent carbon build-ups when operating at low excess oxygen in fluid bed cracking?

DANIEL: The main thing is watching temperature differential between the dense and dilute phase. Whenever your dilute phase drops relative to the dense phase, you're building up coke.

HOUSTON: We have one technique that possibly others of you may be using. On one unit we use a controlled amount of segregated heavy feed stock which is a high carbon producer. We can control the amount of this high carbon producer into the reactor as an aid in controlling the excess oxygen.

MATTIX: We have for years run with low oxygen concentration in the flue gas. We have put an instrument on to give us the amount of burning-temperature pickup in our spent-cat return line and up to the regenerator. As your carbon level builds up, you get more burning in this line which will give you a temperature rise. Our operators operate by it and pretty well ignore the catalyst results coming back from the laboratory. They'll usually check, but this gives them an instantaneous indication. It's no direct reading.

HICKS: I'd like to know what yardstick or measure is generally used for determining the level of contamination in a unit?

MATTIX: We use the hydrogen produced in cubic feet per barrel of conversion. We can follow contamination very closely with this factor.

HOUSTON: We use essentially that same relationship in another number, we call it the unit hydrogen factor, which is the ratio of hydrogen to methane in the off gas or residue gas.

BUMGARDNER (Cities Service Refining Co., Lake Charles, La.): A catalyst salesman dropped by a while back and said that someone in East Texas uses an index based on the various metals content of the feed or on the catalyst. I was wondering if anybody would care to comment on that? It's used for correlation of contamination.

MATTIX: As I know metal analysis, this is a rather inaccurate analysis, very difficult, very slow and very time consuming. We could see the results much quicker on the unit than we could trying to look at metals analysis on feed.

DOYLE: What relationship is there between metal poisoning and distillation range? Is there some sharp break point where it gets real high? We got into metal poisoning. It's primarily due to poor vacuum operation and entrainment. Is there a break point in distillation where you could stay away from it if you had a decent vacuum tower?

NORRIS: We've studied that particular type of problem more than once and the best I can say is that most people have problems with entrainment only when they get carry-over in vacuum or other flash distillation. The exception to this is deasphalted oil. There is one special category of poisoning that comes over in distillation that I don't know of happening anywhere but California. Some California stocks of back around 1944-45 caused poisoning from cracking of distillate fractions. There was a copper compound that boiled around 700°-750° F. range actually occurring in those crudes which contaminated catalyst.

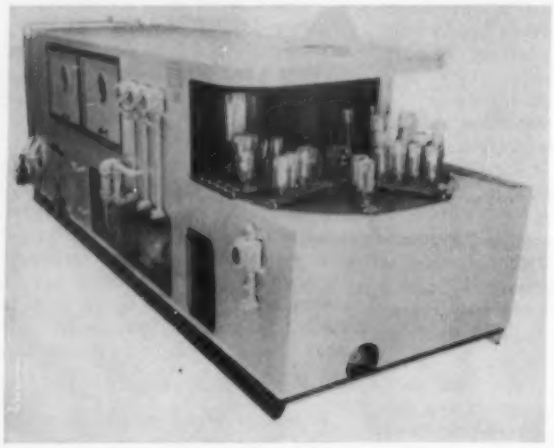
MATTIX: We have gotten into catalyst contaminations through our vacuum unit also. We find that for the same percentage of carbon residue, vacuum distillate is much the worst. We had to cut the carbon residue and control it on our vacuum unit to get out of this particular problem. We are running 0.25% carbon residue on the heavy vacuum gas oil to keep out of that trouble.

ADAMS: We have two types of crudes at Duncan and one of them we have to run at much milder conditions on vacuum operation in order to keep vanadium and nickel out of the cat feed. We definitely feel that some of these compounds are volatile enough to be distilled into heavy gas oil.

KERNS: We believe we have a copper problem. We have in progress right now a volatility study on nickel, vanadium, and copper in our heavy gas oil. The early data in the lower vaporization range have shown only a very slight trend, however.

▶ ▶ ▶ New Equipment Section

This week's SHOWCASE features . . .



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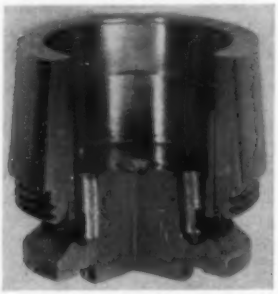

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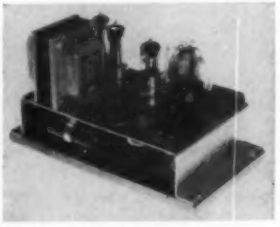

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PUMP VALVES AND SEATS • SWABS • VALVES • HAMMERDRILS • CENTRIFUGAL PUMPS

59-300

liners as small as 4 in. It fits any place in the tubing string. Thus heat can be applied to the desired point for optimum recovery. The 35-ft. heating element is hung from standard API tubing. Installation time is made fast with quick-fastened, self-aligning cable clamps.

Heart of the heater system is an electronic controller (see photo) used in conjunction with a thermistor installed in the downhole heating element. Any desired bottomhole temperature in the range of 100° to 300° can be maintained to within 1° F. of the set point.

When the bottom-hole temperature equals that preset on the control panel, the controller automatically regulates the flow of electricity to maintain the desired temperature. This makes for economical operation and prevents overheating. **Write or call: Macdell Heater Co., 7215 Beverly Boulevard, Los Angeles 36, for details on bottom-hole heater.**

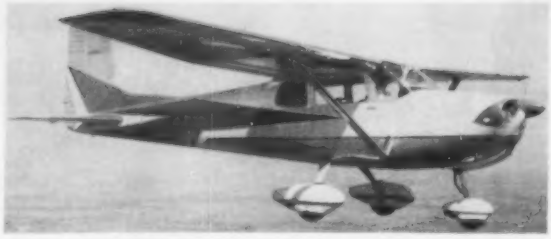
●

Underreamer uses rock-bit cutters

. . . and can be run to any desired depth with the cutters in a closed position. When the tool is in place pump pressure is built up to increase velocity of fluid through the bit nozzle. This forces a piston upward to expand the cutter wings.

Pump pressure is gradually increased while rotating the tool until the cutter wings reach maximum set diameter. When this point is reached, another set of pistons hold the cutter wings in position. When cutting is completed the pump is shut off and the tool is retrieved.

Tool design has eliminated mechanical loads on the cutter wing pins. Worn cutters can be quickly and easily changed on the rig floor, the maker reports. Cutters are made of carburized steel and hard-faced with tungsten carbide. **Write or call: International Tool & Supply Co., Inc., 45 Rockefeller Plaza, New York City, for details on Underreamer tool.**

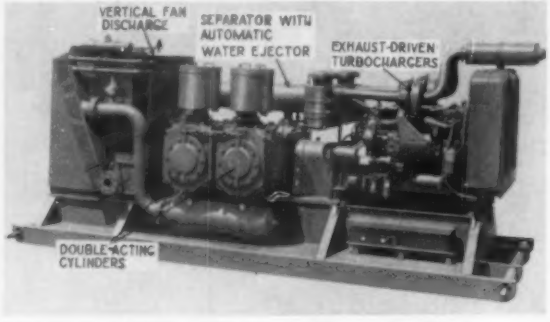


Powered by a 175-hp. engine at speeds to 147 m.p.h. . . .

Plane has automatic flight system

. . . as optional equipment. Highlights of the new model of the Cessna 175 include complete restyling of the exterior, which will be available in seven colors, and a suspended floating cowl that allows the cowling to float freely over the firewall, greatly reducing the transmission of engine noise and vibration into the cabin area.

Interior refinements include the addition of a new contoured control wheel, aluminum-alloy interior door handles, easy-to-use control knobs, and a restyled instrument panel. Radio equipment is mounted on the top center line of the panel. The pilot can operate the radio equipment without diverting his vision from the direction of flight. **Write or call: Cessna Aircraft Co., Wichita, Kan., for details on Model 175.**



Skid-mounted and a self-contained package . . .

Compressor plant for air drilling

. . . is weatherproof and designed to be carried on a conventional highway truck to the drill site. At the drill site, it can be set on timbers or on level ground to provide continuous supply of air for drilling. No special foundation is needed.

The plant can be quickly hooked up for operation. The compressor is a two-stage reciprocating type with channel valves and forced-feed lubrication to all moving parts.

One feature of particular value is an adjustable regulator on the compressor that maintains the desired discharge pressure. When the set pressure is reached, the regulator unloads the compressor and slows the engine to idle. When pressure drops, the engine returns to driving speed and the compressor starts pumping. If trouble occurs, both the engine and the compressor automatically shut down.

The plant has a four-unit forced-air cooler that is driven from the compressor shaft by a V-belt. **Write or call: Ingersoll-Rand Co., Eleven Broadway, New York 4, for details on air-drilling compressor plant.**

●

Triplex pump has built-in dampener

. . . on the suction side to keep harmful pressure surges from entering the piping and to promote better filling. The J-125 pump is rated at 125-hp. input and is available with fluid ends for low-pressure, high-volume; medium - pressure, medium - volume; or high-pressure, low-volume pumping.

Rated maximum pressure is 7,500 psi. Maximum rated speed is 400 r.p.m.

The pump is a single-acting type with a 5-in. stroke. Potential applications include water flooding, salt-water disposal, subsurface hydraulic pumping, high-pressure testing, gathering service, formation fracturing, and acidizing.

Crankshaft extensions on each side of the pump allow direct connection of the driver or V-belt drive without reversing the crankshaft. The extensions also make it easy to connect auxiliary drives such as chemical, sump, lubricating, or charging pumps. **Write or call: National Supply Co., Two Gateway Center, Pittsburgh, for details on J-125 pump.**

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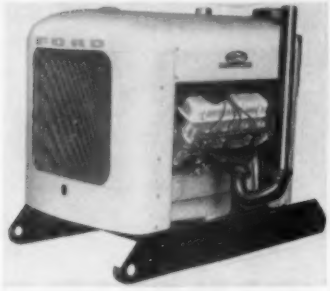


Industrial engine with 534-cu. in. displacement

. . . comes complete with skid mounting, electrical system, radiator assembly, and other components. Ford also announces the availability of two other gasoline engines of 401 and 477-cu.-in. displacement and a 330-cu.-in. six-cylinder diesel engine.

All power units are obtainable with transmissions, torque converters, and SAE housings, which permit customized installation in most cases. These additions extend the company's line of products to include Models 220 and 330 diesels, two four-cylinder, one six-cylinder, and five V-8 gasoline engines. **Write or call: Ford Div., Ford Motor Co., P. O. Box 608 Dearborn, Mich., for details on industrial engines.**

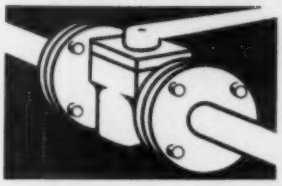
•

Mechanical dock-leveling ramp

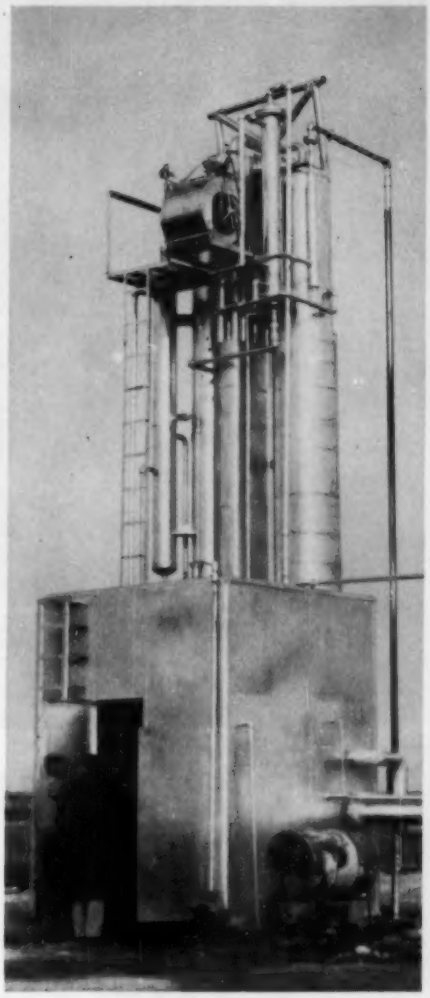
. . . returns instantly and automatically to a locked horizontal position after each use, according to the manufacturer. In this position, the ramp's 6 by 8-ft. platform is flush with the surrounding dock area.

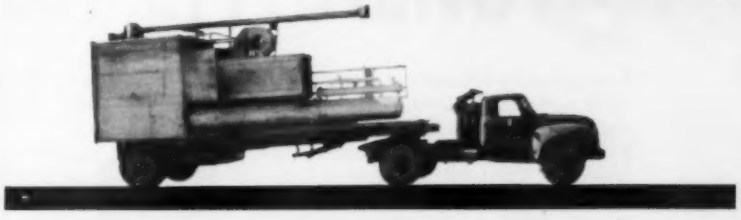
The platform has a supporting capacity of 20,000 lb., both for rollover and crossover loads. Hinged to the dock edge, the platform is actuated

well shut in because gas is sour?

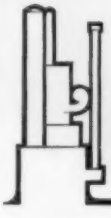


Automatic portable treaters are immediately available for rent, lease or outright purchase.

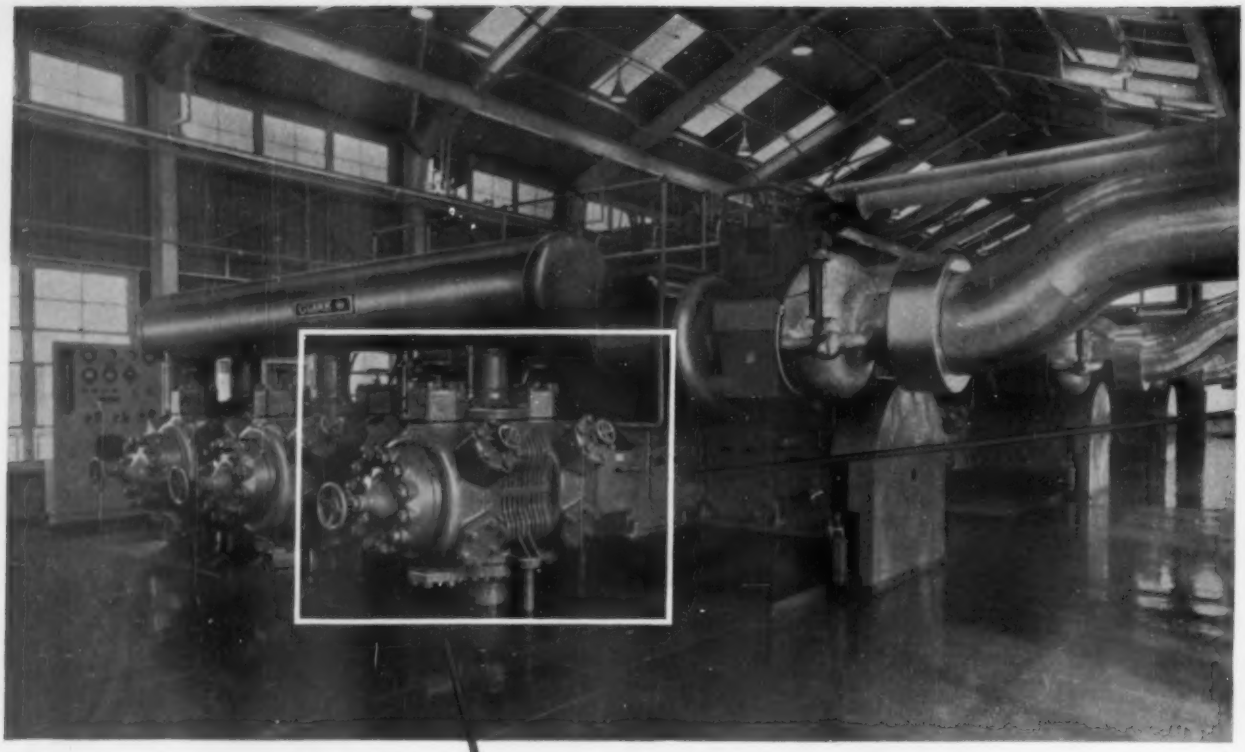




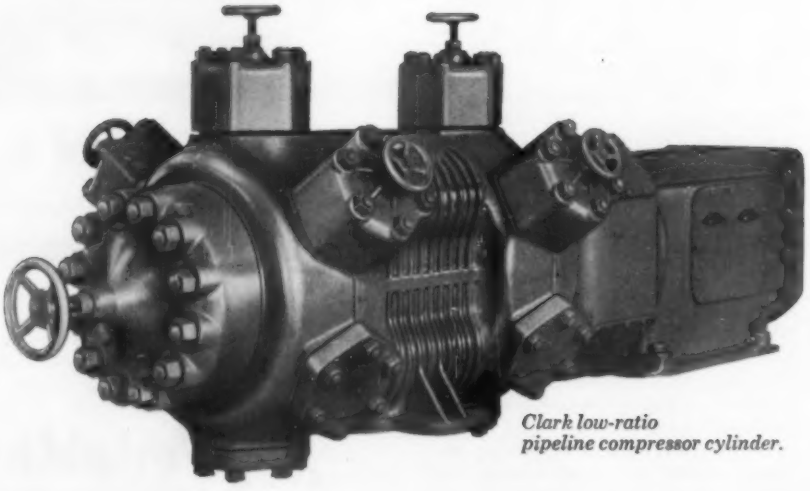
See our EXHIBIT at the Tulsa Oil Show. Space 46, Texas Building



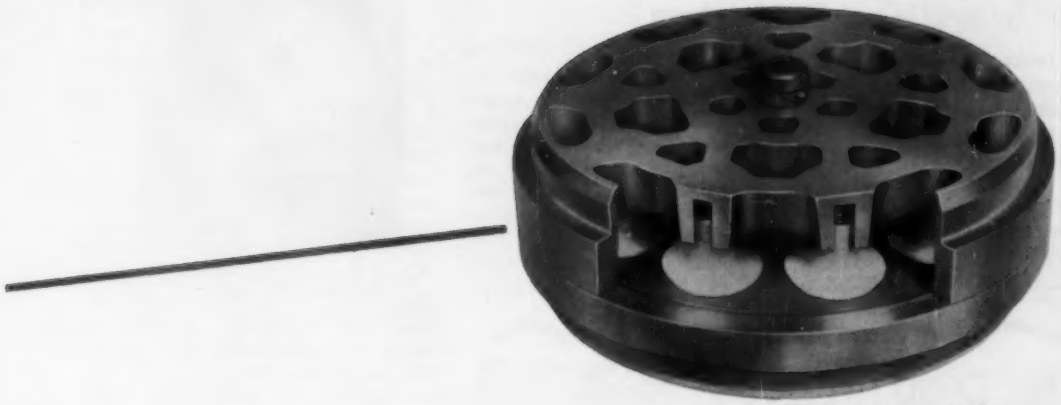
Portable Treaters INC.
P. O. Box 3627 • Odessa, Texas • FEderal 7-6013
Gas Desulfurizers and Dehydrators



NEW CLARK CYLINDER INCREASES



Clark low-ratio pipeline compressor cylinder.



Clark nylon poppet valve for pipeline application.

AND VALVE DESIGN... COMPRESSOR EFFICIENCY 15%

Unequaled loading flexibility plus optimum compression efficiency at ratios of 1.2 and less... and it is all wrapped up in one compressor.

A newly introduced low ratio compressor cylinder and matching nylon poppet valve now make it possible to install Clark TLA reciprocating compressors in *every* pipeline compressor station with complete assurance that the most efficient compressor ever developed for low ratio pipeline application is on the job. There is no longer any reason to differentiate between primary and intermediate stations . . . the TLA will handle them both with unmatched economy.

The problem faced by designers of reciprocating compressors for low ratio pipeline service has always been that too much of the compressor cylinder's suction stroke has been wasted in drawing a vacuum to open the suction valves. That meant wasted horsepower and reduced capacity.

But this is now completely changed. The light weight poppets of the field proved Clark valve open immediately upon piston reversal. Furthermore they open wide to permit a completely free flow of gas into the cylinder. Extra large, streamlined internal manifolds in the new cylinders and extra large suction and discharge nozzles hold pressure drop through the cylinder to an irreducible minimum. The new nylon poppet Clark valve is so efficient that it is rarely necessary to double deck them.

But efficiency is only part of the story. These new valves are literally maintenance free. Continuous runs of over 30,000 hours have been made without maintenance. Valves have thus been field proved for three and one-half years while the "new" cylinders have been operating for over a year. Your nearest Clark office has the complete facts or write for Bulletin No. 168.

CLARK BROS. CO.
OLEAN, NEW YORK

CLARK®

COMPRESSORS • GAS TURBINES

by the backing action of the carrier pushing against a flexible mounted bumper-bar assembly. Hinge connection to the dock is flexible—permitting a 4-in. side-wise tilt of the platform if the carrier bed should be out of level.

As the truck backs up, the spring-and-cam compensating mechanism first raises the lip of the platform, then allows this to pause momentarily while the backing action of the carrier continues, and finally descends gently to the carrier bed. **Write or call: Globe Hoist Co., East Mermaid Lane at Queen Street, Philadelphia 18, for details on Type TM-68-LL mechanical ramp.**

●

Fin tubes have support band

. . . that becomes an integral part of the tube and eliminates divider strips and support bars. The zinc band prevents mashing of lower layers of tubes and facilitates the easy removal of damaged tubes. It fills the area between a number of fins in being precision cast directly to the tube.

Since the bands are uniformly spaced, they rest on top of one another after fabrication in heat-exchange equipment. They can't slip or slide out of alignment and won't cut into the tube, the maker says. The bands will withstand temperatures up to 600° F. and are corrosion resistant. **Write or call: Arrow Industrial Mfg. Co., 821 West Twenty-first Street, Tulsa, for details on Aimco zinc-support bands.**

●

Snap-on aluminum entrance fitting

. . . may prove a time-saving device as only three sizes are needed on the job to permit installation of 1¼, 1½, or 2-in. threaded or nonthreaded heavy or thin-wall conduit. The only tool needed is a screw driver.

The fitting consists of only three parts—hub, cover, and insulator. To install it, simply slide the hub down over the conduit until it rests on the built-in self-centering pipe stop, tighten the set screw, and pry off the cover with a screw driver. Then thread the lead-in wires through the insulator, and slide the cover back along the hub cover guides until the self-locking grippers snap in place.

Another advantage of the Series EF fitting is that all points of strain are adequately reinforced. The semi-punched insulator is automatically positioned by reassembly. **Write or call: Appleton Electric Co., 1701 Wellington Avenue, Chicago 13, for details on Schedule EF entrance fitting.**

ANNOUNCING:

. . . the appointment of new CATERPILLAR Dealers in EASTERN OKLAHOMA . . . for a territory formerly served by McCORMICK MACHINERY COMPANY . . . for the nationally-known

CATERPILLAR

EARTHMOVING EQUIPMENT-TRACTORS-ENGINES
MOTOR GRADERS-PARTS AND SERVICE

The plans, policies and pleasant service of the McCormick Machinery Co. will be continued by Dick Albert and Jack Harlow, new Caterpillar dealers, both of whom have had years of sales experience in oil and construction work. Personnel will remain the same: the main change is the name. They are ready to offer you the finest in Caterpillar parts, service and used equipment. Stop by and get acquainted . . . now!

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SHOWCASE . . .

New Literature

Engineering for the Process Industries

. . . is the title of an available 72-page hard-cover book, free upon request. The four-color publication offers a birds-eye look at an English engineering firm—what it does, how it operates, its establishments, construction, and overseas arrangements. The book contains numerous photographs along with plant layouts and testing procedures. **Write or call: W. J. Fraser & Co., Ltd., Harold Hill, Romford, Essex, England, for Engineering for the Process Industries book.**

Three electric-generator types

. . . are pictured and described in new four-page Booklet F-141. Types include: (1) alternating-current models (1,500 to 10,000 watts); (2) battery-charging models (1,500 to 5,000 watts); and (3) tractor-drive models (4,000, 7,000, and 12,000-watt sizes). The booklet contains specifications of various controls (a.c. switchboards, rheostats, wall-mount switchboards, and manual transfers) which operate each generator. **Write or call: D. W. Onan & Sons, Inc., 3628 University Avenue, S.E., Minneapolis 14, for Booklet F-141.**

Corrosion-prevention systems

. . . known as Metco Metallizing are detailed in new four-page Bulletin 93XG. The systems constitute a series of techniques developed through the use of properly treated pure metals which are firmly bonded to a steel base by metallizing. The metal coatings assure low-cost, positive protection against oxidation for 25 to 50 or even 100 years, according to the bulletin. The publication also pictures some typical applications on a broad range of equipment and structures. **Write or call: Metallizing Engineering Co., Inc., 1101 Prospect Avenue, Westbury, Long Island, N. Y., for Bulletin 93XG.**

Literature index lists

. . . all available literature from a manufacturer's industrial and valve divisions. The 24-page bulletin gives the title and ordering numbers of various product catalogs, specifications bulletins, instrumentation data sheets, and technical, industrial, and systems bulletins. The index includes an alphabetical list of magazine articles dealing with instrumentation. **Write or call: Minneapolis-Honeywell Regulator Co., Wayne and Windrim Avenues, Philadelphia 44, for Index of Literature, Bulletin G2-1a.**

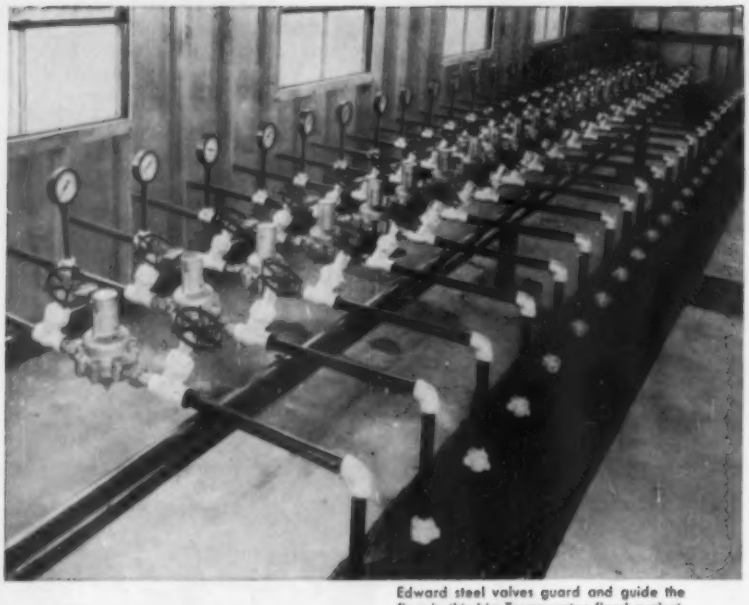
Explosives, blasting agents

. . . and supplies are listed in a new 82-page catalog, which includes a summary of explosives' properties and an index which describes each. The catalog features the following new blasting agents: (1) Dynatex, a nitrocarbo nitrate suited to construction blast work; (2) Kanite, a nitrocarbo nitrate packed in cylindrical metal containers to provide protection from water; and (3) desensitized explosives, high explosives which retain the strength of their respective sensitive grades, but are so formulated that a strong primer or booster is needed for their detonation. **Write or call: Hercules Powder Co., 917 Market Street, Wilmington 99, Del., for 1959 explosives catalog.**

Chemical-analysis system

. . . that can analyze trace materials down to parts per billion and continuously record results with an accuracy of 1% is detailed in a new eight-page bulletin. It shows how the compact system—called AutoAnalyzer—automates analytical procedures in laboratories and controls product

Up to 20 H.P.
Single Phase
Power for remote areas
NEW
R&M
"All Weather 40"
OIL COUNTRY MOTORS
Eliminate maintenance and the problem of constant attention by replacing Internal Combustion engines with R&M Single Phase Motors! Sizes above 7½ hp (10, 15, 20 hp) have "cushion start" system as extra-cost option, for reduced current starting. Auxiliary mechanism is externally mounted for simple inspection, even while the motor is running. Motors are fully weatherized against moisture, dirt, heat. Write for Bulletin 470-OG!
ROBBINS & MYERS, INC.
MOTOR DIVISION • SPRINGFIELD, OHIO



Edward steel valves guard and guide the flow in this big Texas water flood project.

"No maintenance in more than a year

for these Edward Globe Valves in water flood service!"

By JACK STIVERS,
Drilling and Production Supt., Miami Operating Co., Inc., Abilene, Texas

"Over a year ago," says Jack Stivers, "we installed forty-two of these Edward forged globe valves on the KMA Unit, Kempner Field, Wichita County, Texas, Flood. They've throttled since the day we started the flood—and we've had absolutely *no* maintenance costs so far. 2,063,905 barrels of water have been metered through these valves. Yet they *still* shut off tight—without forcing—to isolate meters. Bud Oweiss, our Edward representative, recommended this type of valve, and we are glad we followed his advice. In fact, we're using the same type on our newest flood, too, at Acme Unit, Clay County, Texas."

The Edward valve recommended for this service was Fig. 2698 forged steel, inside screw globe valve. This valve has a precision-built interior, with no pockets to collect sediment; EValized bonnet and packing nut to prevent thread galling . . . and centerless ground stem for long packing life—and packing is easily adjusted or replaced, if ever necessary. If you've been on the lookout for an efficient, dependable valve for water flood service—and want it at moderate cost—you'd be wise to contact your favorite oilfield supply store, or write Edward Valves, Inc., 1212 West 145th Street, East Chicago, Indiana. Subsidiary of Rockwell Manufacturing Co.

Fig. 2698
2000 lb WOG
Globe Stop
Valve

EDWARD STEEL VALVES
another fine product by
ROCKWELL

quality in plants. The bulletin describes principles of operation and the system's new concept that automates each step of manual analysis and eliminates absolute measurements. It gives complete description of the system's components. The bulletin also lists industrial applications as well as specific analysis for a wide variety of trace materials. A special section is devoted to water analysis. **Write or call: Technicon Controls, Inc., Chauncey, N. Y., for Auto Analyzer bulletin.**

Motor eliminates "rocking the beam"

. . . as described in new four-page Bulletin GEA-6546. Pictures, diagrams, and text show the motor which has 400% starting torque, allowing it to start with counterweight in any position. A cutaway view illustrates internal construction. Rating and dimension data is included. **Write or call: General Electric Co., One River Road, Schenectady 5, N. Y., for Bulletin GEA-6546.**

Ductile-iron products

. . . are outlined in a new 36-page catalog which gives technical information including grades, specifications, dimensions, weights, uses, and applications. Typical applications include underground piping, industrial piping, well casing, tanker piping, and component parts for hydraulic-cylinder assemblies and industrial machinery. **Write or call: American Cast Iron Pipe Co., P. O. Box 2608, Birmingham, for Ductile-Iron catalog.**

74-page automatic-controls catalog

. . . deals with liquid-level controls; electronic, time, and magnetic switches; and industrial timers. The catalog consists of a series of bulletins which are bound together. It includes numerous schematic drawings, photos, specifications, and applications. **Write or call: Lumenite Electronic Co., 407 South Dearborn Street, Chicago 5, for Automatic-Controls catalog.**

Scale and corrosion control

. . . solution is offered in a new available publication. The circular is in the form of a telescoped sheet of 11 different drums—each a glucosate directed to some special use in correcting and controlling scale and corrosion factors. **Write or call: D. W. Haering & Co., Inc., P. O. Box 10337, San Antonio, for Solution to Your Problem of Scale and Corrosion Control circular.**

TEX-Lift LONG STROKE
Hydraulic Pumping Units

Straight lift, smooth stroke . . . fully controlled to meet every stripper well condition

Low cost TEX-lift closed-system hydraulic pumping units with variable polished rod velocity and cyclic rate and a wide selection of stroke lengths assure precise control of suction pressures to allow maximum recovery with no damage to production formation. The pumping unit is connected directly to the well head; with the pumping and power units having a minimum of moving parts requiring no special foundation.

Write today for Catalog TL-571-A

1 LOW ORIGINAL COST
2 REDUCED MAINTENANCE
3 INCREASED RECOVERY

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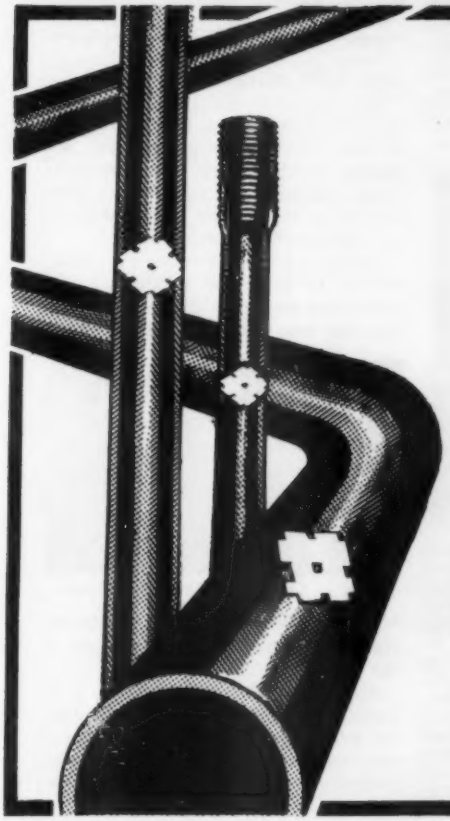

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Cable Address: "SUMITOMOMETAL TOKYO"

Caterpillar names Albert & Harlow, Inc., Oklahoma dealers

Tulsa company takes over ... the Eastern Oklahoma dealership formerly owned by W. F. McCormick, head of McCormick Machinery Co., who is retiring. The new firm will handle Caterpillar Tractor Co.'s diesel tractors, earth movers, and other equipment in 34 counties and will retain the sales and service personnel employed by McCormick.

E. R. Albert, Jr.

J. B. Harlow

E. A. Albert, Jr., president and general manager, started his oil-industry career with Gulf Oil Corp. and in 1939 joined Baroid Division of National Lead Co. He left Baroid to organize Mud Products, Inc., in 1946. When the company was acquired by National Lead 10 years later, he served as president of Rubrite, Inc.

Recently Albert was controller for a joint venture involving Midwestern Constructors and Walco Engineering Co., Inc., in the construction of a Florida gas line.

John B. Harlow, secretary-treasurer of the new firm, joined Albert in the formation of Mud Products, and later worked with Albert in several petroleum-industry ventures.

Harlow remained with National Lead after the company's merger with Mud Products. He left the company when general offices were moved from Tulsa to Houston.

Hunt adds Medders, Foreman ... to its Fishing Tool Division and announces plans to expand division operations, reports T. N. Hunt, president of Hunt Tool Co.

Weldon Medders will be in charge of research and development in connection with new techniques and methods of recovery. He was formerly chief engineer at Houston Oil Field Material Co.

Weldon Medders

Bruce Foreman

Bruce Foreman, another former Homco employe, will be in charge of product design and will direct all field-engineering activities. The firm also announced plans to enlarge present facilities and to open new service points.

Jones & Laughlin announces ... changes in its Canadian organization.

J. R. Windle, salesman at Edmonton, Alberta, was transferred to Calgary, Alberta, and W. J. Chisholm, former store manager at Drayton Valley, Alberta, was appointed salesman and transferred to Edmonton.

Meanwhile, A. M. Suitor was named to take Chisholm's place as store manager at Drayton Valley.

Windle started with J&L in 1951 as a salesman at Edmonton. Chisholm joined the company as storeman at Stettler, Alberta in 1953. He was promoted to salesman there in 1955 before taking over as Drayton Valley store manager 2 years later. Suitor joined the company at Drayton Valley in 1954 as storeman.

Baroid Division establishes ... two drilling-mud stockpoints in Alaska. Allen Oil Tools Co. is a Baroid warehouse representative with a stock in its Seward warehouse. Another mud stock is maintained at the Soldotna facilities of Weaver Bros., Inc. A complete line of Baroid drilling-mud products is offered from these points. Baroid is a division of National Lead Co.

DISCUSSING RETIREMENT — Rodney S. Durkee, after spending more than 40 years in the oil industry, talks over future plans with John J. Neale, president of Lane-Wells Co. Most recently Durkee was chairman of the board of directors and chairman of Lane-Wells' advisory committee. He served as company president from 1939 to 1954. Durkee started with Lane-Wells as executive vice president in 1938. After the company was purchased by Dresser Industries, Inc., he served as a director and member of the executive committee of Dresser for 3 years.

COOLING TOWER with Louvre overhang reduces tower base requirements 20%, thus resulting in substantial cost savings. The cross-flow tower at Arco, Idaho, is being built by Slough-De-Flon for Argonne National Laboratory.

Otis shifts division managers Bob L. Crain was named to manage Otis Engineering Corp.'s eastern division office in Longview, Tex., replacing D. S. Simon who resigned. Crain will supervise sales and service operations in the East Texas, Arkansas, and northern Louisiana area.

Crain, a 15-year veteran with Otis, returns to Longview to assume the same position he held there 6 years ago. He was transferred to the Oklahoma City branch in 1953, and most recently served as division manager at the Corpus Christi office.

Bob L. Crain

R. W. Dickeson

R. Wayne Dickeson was named to replace Crain at Corpus Christi, where he will supervise sales and service operations in South Texas. Dickeson formerly was division manager of the Odessa, Tex., branch.

Franklin opens Alaskan branch

. . . at Seward, thus becoming the first supplier of petroleum equipment to offer warehouse facilities and resident representation in the forty-ninth state. The announcement comes from Jene Harper, president of Franklin Supply Co.

Leland (Pelie) Strouse, vice president and director, is in charge of the firm's entire Alaskan operation. He is headquartering in the Calgary, Alberta office. Chester W. Allen was named company representative.

In addition to the Seward warehouse, land is being cleared for a pipe storage yard at Soldotna.

Waugh named general manager

. . . of Lummus Co. Canada, Ltd. R. J. Waugh joined Lummus in London, England 8 years ago as a process engineer. In 1956 he left to join DuPont Co. of Canada and rejoined Lummus in October 1958.

Bovaird acquires store

. . . in Carmi, Ill. to replace the Grayville, Ill. store which was destroyed by fire in January. The new store formerly was a branch of Eagle Supply Co. This enables Bovaird Supply Co. to continue to serve the tri-state area, including an office at Mt. Vernon and stores at Clay City and Salem, Ill.

Store manager at Carmi is Burlyn D. Price and the field salesman is W. W. Marckley.

Rex. B. Grey named to manage

. . . the Control Division of Southwestern Industrial Electronics Co., a division of Dresser Industries, Inc. Grey comes to SIE from Texas Apparatus Co., which he founded in 1954. Before that he worked for General Electric Co. for 10 years.

Leonard H. Busby appointed

. . . regional sales representative for Security Engineering Division, one of the Dresser industries. He will maintain offices at Security's main plant at Dallas, reports Claude L. Griffin, sales manager for the United States and Canada.

Busby has had 10 years of engineering and sales experience with American Iron & Machine Works Co. throughout Texas and active drilling areas in the South.

R. B. Tunnell is transferred

B. B. Tunnell

. . . from store manager at Arkansas City, Kans., to sales manager of Republic Supply Co.'s Shreveport, La., sales office. The announcement comes from C. J. Jump, general sales manager. Tunnell began with Republic in 1955 and served as a pump repairman, field sales representative, special sales representative, and store manager at Healdton, Okla., before assuming his Arkansas City post.

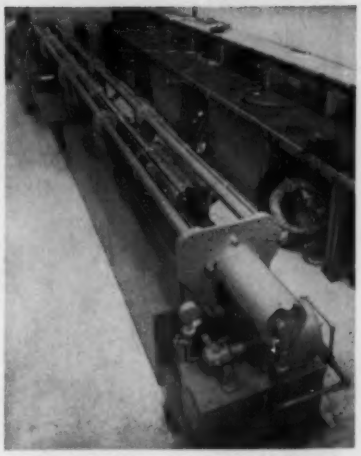
C. F. Mullins will take over the job formerly held by Tunnell at Arkansas City. Mullins was with Pure Oil Co. and Great Lakes Pipe Line Co. before he joined Republic 3 years ago.

D. G. Wiebe appointed manager

. . . of Milwhite Mud Sales Co., Ltd., according to E. C. Buffington, president. Wiebe joined Milwhite in 1956 and has served as sales manager since that time.

PESA members hear speech

. . . by Robert M. Feemster, New York business executive, at the association's eastern district meeting held recently at Pittsburgh. The district is headed by J. G. Seiler of Tube-Turns Division of Chemetron Corp.



CABLE TESTING is carried out on this "extension bench" designed and built by engineers of Schlumberger Well Surveying Corp. It's located in Schlumberger's Houston laboratory. The device enables study of strength, stretch characteristics, and deterioration rate on logging and perforating cables. A "floating" piston in the hydraulic cylinder at the near end allows free rotation of the cable while under tension. A heating jacket encloses the test cable. The extension bench can test a 25-ft. length of cable, apply a maximum tension of 20,000 lb., and measure elongation with an accuracy of one-thousandth of 1%.

Core Laboratories completes

. . . arrangements for installation of an electronic digital computer, Type 650, at its Dallas IBM center. The data-processing facility is under the supervision of H. M. Shearin, assisted by Dr. Frank C. Kelton and Ray Hyman.

W. L. Horner, vice president and manager of the firm's reservoir-engineering department, noted that the equipment will be used on a consulting basis and should greatly speed-up various phases of secondary-recovery studies, evaluation and reserves reports, and associated engineering work.

M. J. Crose Mfg. Co., Inc., holds annual sales meeting in Tulsa

The yearly affair was presided over by Clare G. Miller and T. J. (John) Behrenfeld, president and vice president of Crose, respectively. More than 35 of the firm's key personnel—sales representatives, engineers, and field-service men — attended. John Brand headed the group from the company's Canadian subsidiary, Crose-Curran, Ltd., in Edmonton, Alberta. Groups from across the United States were headed by branch managers Ben Montgomery, Houston; Dave Wagner, Elizabeth, N. J.; and Buck Royal, Denver.

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Among the Drilling Contractors

DRILLING CREW on the floor of a rig operated by Cia. Perforadora Latina, S. A. (Latin Drilling Co.) takes it easy after completing the 100th well this contractor has drilled for Petroleos Mexicanos. Standing, left to right, are: Delfino Segura, tool pusher; Pedro Gallegos Velez Ayte, tecnico de perforacion (drilling engineer); Jesus Sanchez, driller; and Robert Plancarte, mud engineer. The three crewmen in front are: Ernesto Navaneti, Suciano Villalabo, and Angel S. Senilla. The well is the government agency's No. 104, in San Andres field, in the state of Vera Cruz. The rig is the contractor's No. 5.

Who's getting the drilling contracts

Conroe Drilling Co., Corpus Christi, has a new operation under way in the Ginny area, 9 miles northeast of Gregory, San Patricio County, in Texas' central coastal region. Latest well is for Forest Oil Corp. at 1 Zweig, 1¼ miles southeast of the field's discovery well, completed a year ago by Texan Oil Co. with oil production from an 8,300-ft. Frio sand. Forest's well is projected to 9,000 ft.

Carnes W. Weaver Drilling Co., Houston, has a rig running on a new 7,000-ft. wildcat location 6 miles north of Moss Hill, in northern Liberty County, Texas Gulf Coast. It is drilling for Texas Gas Exploration Corp. and Dodgen Oil & Gas Co. Location, at 2 Nona Mills, in the Manuel de los Santos Coy Survey, is a mile south of production.

Rimrock-Tidelands, Inc., New Orleans, has joined with Hellenic Oil & Gas Co. and Argo Oil Corp. in the drilling of a 12,000-ft. Hosston wildcat in eastern Rankin County, South Mississippi. A Rimrock rig will make the hole.

Location, at 1 Gooch, in 30-6n-5e, is 2 miles northwest of Pelahatchie and about 15 miles east of Jackson. Nearest production is Shell Oil Co.'s newly completed oil-discovery well, 1 Rogers, in southwestern Scott County. The latter produces from a 6,400-ft. Eutaw sand after having been drilled to 11,062 ft. in Cotton Valley. It is the first production in Scott County.

Great Western Drilling Co., Midland, is on a new 10,200-ft. Honolulu Oil Corp. contract in the North Smyer-Strawn area of Hockley County, West Texas. Latest operation is 30-A Ellwood Estate, in Section 27, Block A, R. M. Thompson Survey. It is 6 miles north of Smyer. Another new Hockley County contract is in the Ropes area where **Midland Drilling Co.** is drilling for Joseph I. O'Neill, Jr. Midland's new operation, contracted to 9,500 ft., is at 2 Conaster, in League 13, Howard County School Land Survey, 6 miles north of Ropesville.

Dual Drilling Co., Wichita Falls, has a new deep-drilling operation in northern Gaines County, West Texas. It is a contract job for Ashmun & Hilliard and associates of Midland. Location, 1 Bain, in Section 280, Block G, WTRR Survey, is 8 miles northwest of Seminole and 2 miles from production. Permit is for a 12,500-ft. test.

Southland Drilling Co., San Antonio, is under contract to Slick Oil Corp., of Houston, for a 7,000-ft. Frio test to be drilled at a wildcat location 4 miles south of Inez, in eastern Victoria County, Central Texas Gulf Coast. Location, at 1 Hubalek,

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in the V. Garcia Grant, is a mile southwest of production in Witte field. Southland, and Bradco Oil & Gas Co. are associated with Slick in the operation.

Fred Wilson Drilling Co., Shreveport, is keeping its rig in the new Sorrento northwest extension area, in Ascension Parish, South Louisiana, for another well it will drill for Austral Oil Co., operator in the area. The next test, 1 Myers et al., in 9-10s-4e, will be Austral's fourth. Austral's third test, just completed, was dry. Extension discovery well, completed last September, is productive of gas and condensate from a 9,975-ft. sand. The second well was oil-productive from a 10,120-ft. sand. All have been drilled to depths below 11,-000 ft.

Larco Drilling Co., Jackson, Miss., has taken on a deep-drilling job for Weston Drilling Co., also of Jackson, in far-southeastern Mississippi's heretofore unproductive and little explored Jackson County. Its location, 1-J U.S.A., in 15-5s-9w, is 14 miles inland from Ocean Springs, on Mississippi Sound. It is near the Harrison County line on the west. Nearest production is more than 25 miles northwest in the Maxie-Pistol Ridge area.

Lamson-Bennett Drilling Co. is contractor on a 10,000-ft. wildcat test Gulf Oil Corp. is starting in St. John the Baptist Parish, southeastern Louisiana. Location, at 1 Gulf States Land & Industries, in 34-11s-6e, just across the Mississippi River from Edgard, 20 miles up the river from New Orleans.

Crow Drilling & Producing Co., Shreveport, has a rig running on a wildcat location 3 miles southwest of Lewisville, in Lafayette County, southern Arkansas. It is an 8,800-ft. Smackover test for G. B. Christmas, of Texarkana, and David Crow, Trustee, of Shreveport. Location is at 1 Alford, in 25-16s-25w.

Camdrill International, Inc., foreign drilling subsidiary of Southern California Petroleum Corp., has signed up for two additional drilling jobs in Libya. One will drill on a semi-development program for Oasis Oil Co. The other will drill a wildcat on a large concession held by Libyan-American Oil Co. Both projects are in the Tripolitana area of Libya. Camdrill has been operating as drilling contractor for Mobil Oil Co. of Canada and Esso Standard (Libya), Inc., for 2 years in Libya. Ernest (Hi) Pierotti of California will be drilling superintendent for Camdrill in Libya.

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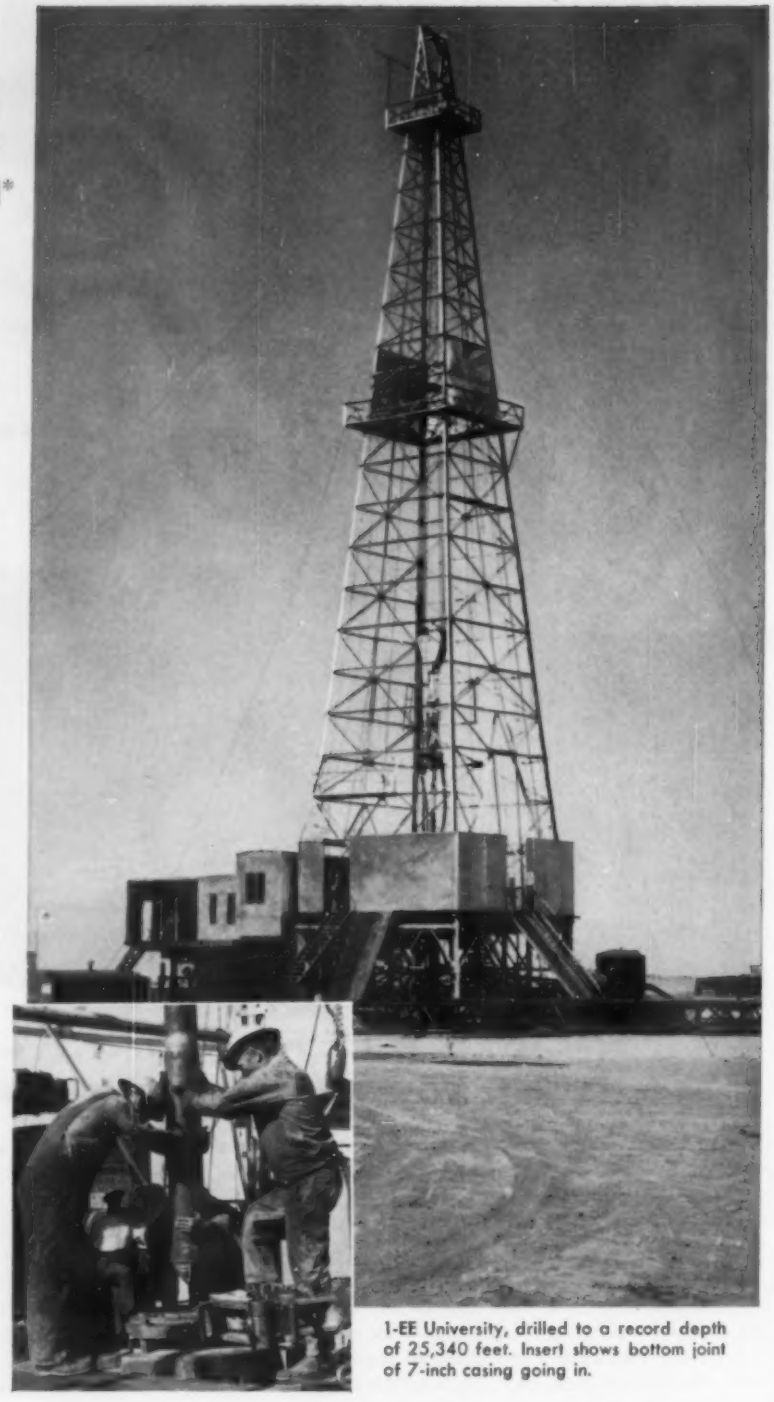

1-EE University, drilled to a record depth of 25,340 feet. Insert shows bottom joint of 7-inch casing going in.

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With six discoveries within the past month . . .

Swan Hills is playing a merry tune

BY FRANK J. GARDNER

FOR A FORMATION that had never produced a barrel of oil before 1957, Canada's Beaverhill Lake-Middle Devonian is doing all right. Before the discovery of oil at Swan Hills, the west-central portion of Alberta, shown on today's map, was a big blank spot as far as oil was concerned. This remote hill country, lying between Lesser Slave Lake and the Athabasca River, was noted principally for its timber stands and grizzly bears. But rich oil strikes at Swan Hills, Virginia Hills, and Kaybob have wrought a major change.

Five new hits . . . After this electrifying start, wildcatters streamed into the Swan Hills country. Swan Hills itself has emerged as a major field, as has Kaybob. But events of the past month would seem to indicate that we have yet to hear from the Swan Hills theater. Important new discoveries have been popping up in every direction from the three original Beaverhill Lake fields.

Checking them off one at a time, we find this quintet of new fields productive from the Swan Hills member of the Beaverhill Lake:

• First was Shell Oil Co. of Canada, Ltd., 6-34 South Swan Hills (LSD 6-34-64-13w5), 4½ miles southeast of Virginia Hills. This one flowed 1,000 bbl. per day on 22/64-in. choke from 9,400 ft. This was Shell's first success in this particular theater.

• Next came McColl-Frontenac Oil Co., Ltd., with a discovery at 2-7 Swan Hills, about 8 miles northeast of Swan Hills field proper (LSD 2-7-69-8w5); this one recovered 1,840 ft. of oil on drill-stem test of the Swan Hills member and is the northernmost strike yet recorded in the immediate area of Beaverhill Lake operations.

• In quick succession three more important reports of success have come out of the hills. Three miles northwest of Swan Hills field, Home Oil reported flow of 984 bbl. per day on 20/64-in. choke at its D-10-17 well (LSD 10-17-68-10w5). In the same week, British American Oil Co., Ltd., and Pan American Petroleum Corp. announced success at their 2-13 Sarah Lake wildcat, 8 miles south of the main field on LSD 2-13-65-11w5; here the flow was 700 bbl. a day from 8,125-70 ft. At almost the same time, Imperial Oil, Ltd., added yet another new one at its 16-31 Judy Creek on LSD 16-31-63-10w5. Judy Creek lies another 8 miles south of Sarah Lake and 15 miles south of Swan Hills field; the well flowed oil after 28 minutes in a test of the Swan Hills member at 8,310-95 ft.

And a reef trend . . . To the west, another play which is just as interesting and significant, is aimed at the Devonian D-3 reefs (see map). Here Shell has reached the pay at its 10-1 Simonette (LSD 10-1-63-26w5); the 10-1 lies 2 miles southwest of Shell's 1958 strike at Simonette 12-9, a reef producer from 115 ft. of pay. This second well topped the reef nearly 100 ft. higher (11,446 ft.) than the discovery and indicates an even thicker pay section.

This Simonette development lies on a trend with the sensational Berland River gas discovery which potentialed in 1958 for 1½ billion cubic feet per day. At the moment, a very important wildcat is drilling about halfway between Simonette and Berland River. This is Phillips 10-3 Deep Valley (LSD 10-3-61-24w5), aimed at the D-3 reef top. It is attracting perhaps more attention than any recent wildcat in western Canada.

Mean a great discovery era . . . Put all these events into your computer, and you can reach only one conclusion: That we are witnessing the growth of the greatest major oil province since Leduc in Canada. Beaverhill Lake discoveries have been made not only in this immediate area, but 116 miles north at Red Earth and 92 miles northwest at Girouxville. This means a minimum area of 25,000 sq. miles in which Swan Hills wildcatters can play. The stakes are a neat billion barrels of new oil.

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Dowell's New "Fracturing Guide" has increased success ratio of oil well fracturing treatments from less than 60% to 97%!

Dowell engineers, working closely with leading oil and gas producers, have now developed a revolutionary new technique for engineering fracturing treatments to yield optimum results.

More than 300 treatments using this new method have been made. They indicate that the success ratio of fracture treatments can be increased by more than 50 per cent.

This new system of designing well treatments is based on tables and graphs contained in a manual now in use by Dowell engineers. In preparing the manual, "Engineered Fracturing Recommendations," Dowell engineers consolidated and correlated industry-accepted calculations, reservoir data, frac fluid properties and their own experience from thousands of treatments. The "Guide" has been equally effective on both old and new wells.

How is the "Guide" used?

First, your Dowell engineer needs a reasonable amount of information about your well. Then he uses the charts and formulas compiled in the manual to design a fracturing treatment to fit that particular well.

The "Guide" helps you:

1. *To choose the proper fluid and additives to meet reservoir conditions.*
2. *To predict the fracture area created on any treatment.*
3. *To choose the proper treating volume on re-treatments.*
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Results have been a spectacular increase in the number of successful jobs. Benefits have included faster payout, lower lifting costs, high production and greater ultimate recovery because of *better decline curves.* Really *engineered* fracturing using the new "Guide" is available *only* from Dowell.

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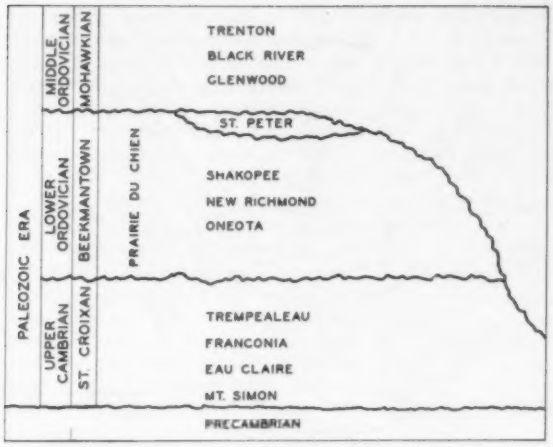


GEOLOGICAL SECTION of deep Ohio formations.

OHIO basement tests are few and far between. Only 23 as shown here have been sunk.

Watch Ohio for deep drilling

BY GEORGE G. SHEARROW
Ohio Geological Survey

OF THE 275 deep wells drilled in Ohio, only 23 have gone to basement. Production has been found in several wells at Tiffin and Caledonia, and shows found in several other isolated wells.

During the last 3 years, considerable interest in deep Ohio sediments has been shown by the industry. Sun Oil Co. drilled two basement tests in Miami and Shelby counties in 1955. In 1956, Gump Oil Co. drilled deep in Shelby County. In 1957, Fayette County had two wildcats drilled to the bottom by Kewanee Oil Co.

Last year, five basement tests were completed in the state — Kewanee drilled one in Fayette County, one in Clinton, and one in Pickaway; National Associated Petroleum Co. drilled one in Miami County, and Wiser Oil Co. et al. moved northeast to Medina County to put down a 7,000-ft hole.

Limited stratigraphic studies indicate porosity and permeability exist in the deeper sediments of Ohio (those below Middle Ordovician). Source rocks probably exist to the south and southeast of the state in neighboring basins.

Tectonic Background

Major geologic provinces surrounding Ohio had a great influence on the Paleozoic sequence. Structural features, controlling the accumulation of gas and oil when the sediments were laid down were different from what they are today.

Lower Ordovician and Upper Cambrian sediments bear characteristics of both the sediments of the Appalachian basin and the Upper Mississippi Valley rocks but are more closely related to the latter. Upper Cambrian rocks occur in the subsurface over the entire state but Lower Ordovician rocks are found only in the southern and southeastern parts of Ohio.

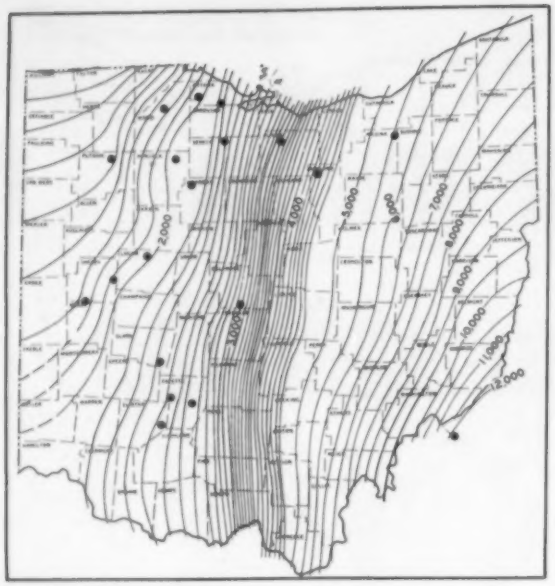
To the east and southeast is the Appalachian basin. The presently high area of eastern Indiana during Upper Cambrian and Lower Ordovcian time was a shallow basin or shelf area. The high shield area of Canada influenced the sediments and was the primary source area for the clastics which dominate these early rocks.

To reconstruct this early picture, the high shield area extended southward under Lake Erie, plunging into the Appalachian basin and the shallow basin of Indiana. These two depressions were connected across Ohio by shallow waters. Deeper waters were found in southern Ohio and Kentucky. The Upper Mississippi Valley area and Appalachian basin were connected through Ohio during Upper Cambrian and Lower Ordovician times.

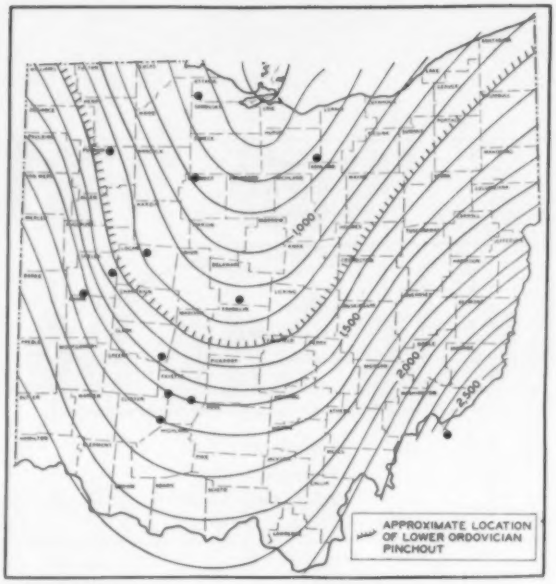
Through these times the weight from eroded sediments being deposited further depressed these low areas and caused the North Central Ohio area to gradually rise. During Lower Ordovician, North Central Ohio was higher than the surrounding area jetting southward into the vast embayment connecting the Upper Mississippi Valley and the Appalachian basin.

The present Cincinnati and Findlay highs were post-Lower Ordovician. It is quite probable that the Findlay high represents a westward migration of the North Central Ohio area at earlier times. Additional downward pressures on the Appalachian basin would cause this peninsula to move westward. Soon after in geologic time the Cincinnati high was formed.

The isopachous map from the base of the Glenwood to the top of the granite wash substantiates this hypothesis. The increased thickening of the sediments from North Central Ohio southeastward, south and south-



STRUCTURE contours on the base of the Mt. Simon sandstone.



ISOPACHOUS MAP from base Glenwood to granite wash.

westward are noted on the isopachous map.

The structure on top of the granite wash is very similar to the Trenton structure map compiled by Stout, Lamborn et al. in 1932.

Statigraphy

The Upper Cambrian overlying the "basement complex" in Ohio consists of sandstones, dolomitic sandstones, sandy dolomites, dolomites, and shales. In ascending order the formations of the Upper Cambrian are the Mount Simon sandstone, the Eau Claire sandy dolomite capped by shale, the Franconia dolomitic sandstone, and the Trempealeau sandy dolomite.

The Mount Simon ranges in thickness from 100 to possibly as much as 450 ft. The interval is controlled by the depth of the basins plus the irregular erosional surface of the underlying basement rocks. The texture of the sand is fine to coarse, locally conglomeratic and subangular to rounded and frosted. The coarser materials are found to the north and northwest with the finer sands deposited to the south. Basinward this sandstone is quite dolomitic. Bonding materials are silica and dolomite.

The Eau Claire ranges in thickness from 400 to 700 ft. The character of this formation covers a multitude of lithologies. The brown to gray shale found at the top is poorly developed in northern Ohio but thickens to 150 ft. in the southern part of the state. This widespread shale is a good marker for the driller and geologist. The balance of the formation is a dolomitic, very-fine to fine-grained sandstone in the north with the sands decreasing in percentage basinward, gradually changing into a buff to brown crystalline dolomite, nearly free of clastics.

The Franconia sandstone ranges in thickness from 40 to 150 ft. The texture is fine to medium-grained, subangular to rounded and frosted. South and southeasterly increasing amounts of dolomite are present.

The Trempealeau, youngest formation of the upper Cambrian, ranges in thickness from 250 to 600 ft. This buff and in part white to gray fine crystalline dolomite contains minor amounts of sand, usually less than 25%. Thin sandstone lenses are found locally but not persistently enough for correlation.

In the northern part of the state where the Lower Ordovician is missing the Trempealeau is overlain by the Black River and Glenwood formations of Middle Ordovician. South of the Lower Ordovician pinchout sediments of the Lower Ordovician or Prairie Du Chien group gradually thicken and attain a thickness of 1,000 ft. at the southeastern edge of Ohio.

The Prairie Du Chien group is composed of three formations. In ascending order they are the Oneota dolomite, the New Richmond sandstone, and the Shakopee dolomite. Detailed lithologies and thicknesses can not be given at this time since so few wells have penetrated the entire Prairie Du Chien group. Chert, silicified oolites, sand, and minor amounts of shale and glauconite have been noted in these sediments.

Directly overlying the Prairie Du Chien in the Upper Mississippi Valley is the St. Peter sandstone. Although St. Peter has been reported by most of the drillers in the deep wells, the writer has found St. Peter sand in 6 of the 275 wells that have been drilled to the Lower Ordovician or Upper Cambrian. A common error on the part of the driller is to call a crystalline dolomite a sandstone. It is probable that since the individual grains drill free they are most often identified as quartz grains. It is often possible, too, that the St. Peter sand will be found in pockets on the erosional surface most anywhere in Ohio. Generally with the St. Peter wanting, a few floating sand grains are noted in the Glenwood shale.

Results to Date

Deep wells drilled in the state have been confined principally to the arch areas. With 275 wells that have penetrated the Lower Ordovician and Upper Cambrian sediments and only 23

THE AUTHOR

The author was employed by the Missouri Geological Survey until 1951 as a subsurface geologist. That year he joined the Ohio Geological Survey as geologist. Presently he is head of the oil and gas subsurface section. Shearrow is well versed in Ohio geology.

wells reaching the basement, further exploration is definitely needed.

Deep pools . . . To date two pools have been found and several other isolated wells have produced oil or gas. Tiffin pool, located in Seneca County, was discovered about 1910. Initial production ranged from a few barrels to as much as 500 bbl. daily.

In 1919 Caledonia pool in Marion County was discovered. Initial production ranges upward to 700 bbl.

At the Newark Fairgrounds in Licking County, oil was discovered in 1924. Wehrle Gas Co. reported this well had an initial production of 150 bbl. and 250 M.c.f. of gas.

The producing horizon in the two pool areas and in the Newark Fairgrounds well was the erosional zone of the top of the Trempealeau rocks, beneath the Glenwood shale.

In Tiffin pool the 1 Crum was completed in 1938 with an initial production of 120 bbl. In the first 8 months 6,200 bbl. of oil was produced. The average annual production after the first year was approximately 1,500 bbl. In 1948, when production figures were last recorded by Sun Oil Co., the well made 1,526 bbl., making a cumulative total of 21,284 bbl.

Wehrle well located at Newark Fairgrounds had an initial production of 250 M.c.f. of gas and 150 bbl. of oil. In the peak production year in 1925, 7,300 bbl. of oil was produced. For the next 10 years the average annual production was approximately 1,200 bbl. This well, according to Clinton Oil Co., produced until June of 1958, when mechanical difficulties necessitated plugging. The cumulative production was 31,795 bbl. Although these figures are not phenomenal, they do give some encouragement.

Records Are Poor

From the scant sample data available, it is noted that suitable reservoir conditions exist in these older sediments in the Mount Simon, Eau Claire, Franconia, Trempealeau, Oneota, and Shakopee formations. Although drillers' records are available on the old wells and a few good strings of samples are on file, additional information is needed to determine structural and stratigraphic conditions which control the entrapment of oil and gas.

Logs . . . Many of the early drillers' records were extremely poor—as are many of today's. The drillers in some cases make little effort to record and preserve what is seen. Many are reluctant to save samples because they feel that they know all there is to be known about the rocks. This may be true but there are others interested. Samples taken carelessly are worse than none at all. Small samples also have a limited use since considerable amounts are needed to run all laboratory and microscopic examinations.

Cores . . . Cores, which are few and far between, are sought by the Survey. Here, again, much of the core is lost by poor packaging. Some important sections are used as desk weights, watch fobs, and so forth, and are lost before geologic investigations are completed.

Research Needed

In order to increase reserves by locating new discoveries, research is needed. All materials, logs, and other data should be saved. The Ohio Geological Survey can and should be used to much better advantage.

Better logging, better coring, and better preservation of these data are necessary before good research can be accomplished. Then detailed investigations will point up new areas worthy of deeper drilling.

The search for deeper zones has paid off in other states—Pennsylvania, West Virginia, New York, and the Oklahoma-Kansas Hugoton embayment. A case in point is seen at home in the recent Ohio Fuel Gas Co. et al. 1-A Smith (a rotary test) in Hinkley Township, Medina County, which produced gas at 5,775-90 ft. near the Cambro-Ordovician contact (OGJ, Feb. 16, 1959, p. 220). It may take time—but one thing is certain—deeper drilling is in store for Ohio.

Discovery sparks new B.C. play

ANOTHER OIL DISCOVERY in the northeastern sector of British Columbia will undoubtedly see a new splurge of development drilling in the general Beatton River-Milligan Creek region.

The new discovery hole was drilled by Sinclair Canada Oil Co. on acreage acquired under farmout agreement from Pacific Petroleums, Ltd., and is centered 20 miles southeast of the two previous oil-development areas Beatton River and Milligan Creek, and some 45 miles northeast of Fort St. John. This new strike was uncovered in the Triassic "D" horizon after the well had been drilled and cased. No drill-stem tests were attempted in the discovery horizon but the well flowed 28 bbl. of light-gravity oil during production tests through a 25-ft. perforated interval.

The Triassic "D" has been British Columbia's main oil-development formation to date with such fields as Boundary Lake, Milligan Creek, and Beatton River producing from it. More recently, however, Trias Oil Co. has had what appears to be major success in the Bluesky horizon in the same Beatton River district, as two wells have now found production from it. Those two wells are sizable stepouts from the Triassic "D" producing portion of that area and were both unproductive in the Triassic age formation.

The new discovery hole, Sinclair-Pacific-Doig D39E (B8-3) is located on Unit 39, Zone E, National Topographic Series Index Map 94-A-16. Sinclair reported that the well was carried to a total depth of 3,910 ft. and casing landed at that depth. The pay zone was contacted at 3,840 ft. and 25 ft. of net pay is present. Perforations were between 3,840-65 ft. and following swabbing operations the well kicked off and initial production test flowed 28 bbl. per hour, or the equivalent of 672 bbl. per day. Production tests are continuing on the well, but first appearances indicate an important strike.

The well is on Permit No. 173, a tract of 48,192 acres that Pacific originally farmed out to Southern Production Co., Inc. That latter company was taken over by Sinclair and all land involved in the Pacific-Southern deal, which incidentally was a large-scale transaction, was taken over by that firm.

Other companies that are sure to benefit from the new strike if it turns out to be a sizable structure, are two separate teams. One of those is the Phillips Petroleum Co.-West Canadian Petroleums, Ltd.-Canada Southern Petroleum, Ltd.-Scurry Rainbow Oils, Ltd., group that holds the adjoining westerly acreage; and the Union Oil Co. of California-Hudson's Bay Oil & Gas Co., Ltd., twosome that holds the adjoining easterly tract. The Phillips controlled team's acreage is at its closest 1 mile due north; while the Union-H.B. tract lies some 1½ miles due east.

Alberta wildcat is dual producer

RECOVERY OF GAS from one formation and significant shows of oil and gas from another on a wildcat well in the South Kaybob area of West-Central Alberta have been reported by Pan American Petroleum Corp.

Pan American 1 Kaybob "A," located on a 100,000-acre Crown Reser-

vation block, flowed an estimated 6 M.M.c.f.d. of dry, sweet gas on a drill-stem test of the Cadomin. Recovery was from the interval 7,310-52 ft., with top of the Cadomin located at 7,310 ft.

A lower drill-stem test from 7,687-7,735 ft. in the Triassic recovered 180 ft. of gas-cut mud and 990 ft. of mud and oil emulsion with no sign of salt water. Operator is now drilling ahead on the well which is scheduled to 10,350 ft. The A-1 is located in LSD 7, 33-60n-9w5.

The South Kaybob area is a part of the West Whitecourt block of over 1,000,000 Crown Reservation acres on which three other productive fields (principally gas) have been developed.

The West Whitecourt block is owned by Pan American, with 41⅔% interest, Hudson's Bay Oil & Gas Co., Ltd., with 41⅔% interest and Canadian Petrofina, Ltd., with 16⅔% interest. Pan Am is operator at South Kaybob, while Hudson's Bay and Canadian Petrofina operate other sections of the West Whitecourt block.

Michigan prospects receive setback

A DRY HOLE and an offset probable failure jarred prospects in the Pulaski, Jackson County, district, overshadowing a successful development-well offset in the same area. Prospects of connection between the older Scipio field 4 miles to the southeast were decreased.

Union Development Co. 1 Groshko, NW NE NW 29-4s-3w, less than ½ mile south of the discovery, logged Trenton objective at 3,658 ft. and drilled dense limestone without oil or gas shows to 4,097 ft. total depth. Carter Oil Co. 1 Blair, SE SE SW 20-4s-3w, the diagonal northeast offset to Union, appeared faring little better. Trenton was logged at 3,692 ft. and drilled to 4,048 ft. had logged only dense limestone.

On the other hand, Sun Oil Co. 1 Blair, NW NE SW 20-4s-3w, northeast diagonal offset to the discovery, logged Trenton at 3,702 ft. and cored over 100 ft. oil-saturated dolomite before casing 5½ in. at 4,055 ft.

Typical of the dolomite fracture conditions in Scipio Trenton field, Sun's promising offset was 19 ft. lower than the discovery while Carter and Union showed raises up to 35 ft. on the Trenton and missed the dolomite.

Scipio . . . Half-mile-south extension of Scipio field was indicated with Don Davis 1 Hughes, SE NW SW 14-5s-3w, Hillsdale County, flowing oil and mud from Trenton at 3,930 ft.

Border play swings to New Mexico

THE DRILLING PLAY for shallow oil in Culberson, Reeves and Loving counties that has stayed hot for nearly 2 years is now warming up on the New Mexico side—in Lea and Eddy counties.

Delaware sand oil isn't new to that area. Poker Lake and North Mason fields (Eddy County) are currently on production, while Jennings pool (Lea County) has come and gone. North Mason had a total of 38 wells on the March proration schedule, with a daily allowable of 816 bbl. Poker Lake is a recent discovery and does not appear on the March allowable schedule.

CURRENT Delaware oil prospects in Eddy County, New Mexico. Dotted outlines around producing fields show the 1958 growth of similar production in Texas.

Discovery prospects . . . Ford Chapman & Associates 1-34 State in 34-26-28e, 6 miles northwest of Delaware production in Ford field, reported a fillup of 200 ft. of oil at 2,516-22 ft., total depth. Operators bailed an unestimated amount of free oil from the same section. Gas production was at the rate of 750 M.c.f.d.

J. Glen Bennett 1 Brunson, 6-26s-30e, flowed 13 bbl. of oil and 55 bbl. of water on initial tests after perforating the Delaware at 3,414-16 ft. It was to continue testing.

Operators reported a possible 24-ft. pay section, according to electric logs. Top of the Delaware sand was picked at 3,357 ft. Continuous coring from 3,365-3,464 ft. recovered 12½ ft. of sand with good gas odor and fluorescence at 3,384½-97 ft., and 13 ft. of sand with good odor, fluorescence, porosity, and permeability at 3,413-26 ft.

The Bennett well is between Hankamer 1 Gulf-Federal, recent oil discovery to the southwest, and Poker Lake field to the northeast.

In Lea County, Hill & Meeker 1 State "36" was testing the Delaware after making a good flow of oil from perforations at 4,609-19 ft. Location in 36-26s-3e is 6 miles southwest of Jennings field, and 5 miles east of North Mason field. It is not shown on the accompanying map.

This prospect had gas in 2 minutes and oil in 47 minutes on drill-stem test of the Delaware at 4,578-93 ft. It flowed 3½ bbl. an hour under tubing pressure of 300 psi. on the test. Twenty-minute shut-in pressure was 1,980 psi.

After running casing and perforating at 4,609-19 ft., a 250-gal. acid treatment and small fracture job boosted the flow to 97 bbl. of 41°-gravity oil in 8 hours through 14/64-in choke.

Oklahoma keeps up exploration pace

NORTHWESTERN OKLAHOMA'S exploratory push continues to highlight other Mid-Continent province news. Discoveries in Woodward, Harper, and Major counties keep the northwestern part of the Anadarko basin up front.

Woodward . . . Sinclair Oil & Gas Co. opened a new Morrow Pennsylvanian gas pool in northern Woodward County at 1 Dotter in C SE NW 31-26n-19w. Location is 5 miles southeast of Harper County's prolific Lovedale area.

Gas flow on completion was 7,120 M.c.f.d. through ¾-in. choke from perforations at 6,388-6,409 ft. Pinched down to 31/64-in. choke, final gage was 5,402 M.c.f.d. with distillate spray and water. This strike opens an entirely barren area of the county to prospecting.

Harper . . . An extension well at North Buffalo, famed multipay discovery of last year, was dually completed by An-Son Petroleum Co. The 1 Miller, C NW NW 8-28n-22w, flowed 132 bbl. of 39.5°-gravity oil per day on ¼-in. choke from the Lansing Pennsylvanian at 4,581-84 ft.; from Arbuckle Cambro-Ordovician it flowed 175 bbl. per day, 41° gravity, on ¼-in. choke from perforations at 7,651-64 ft.

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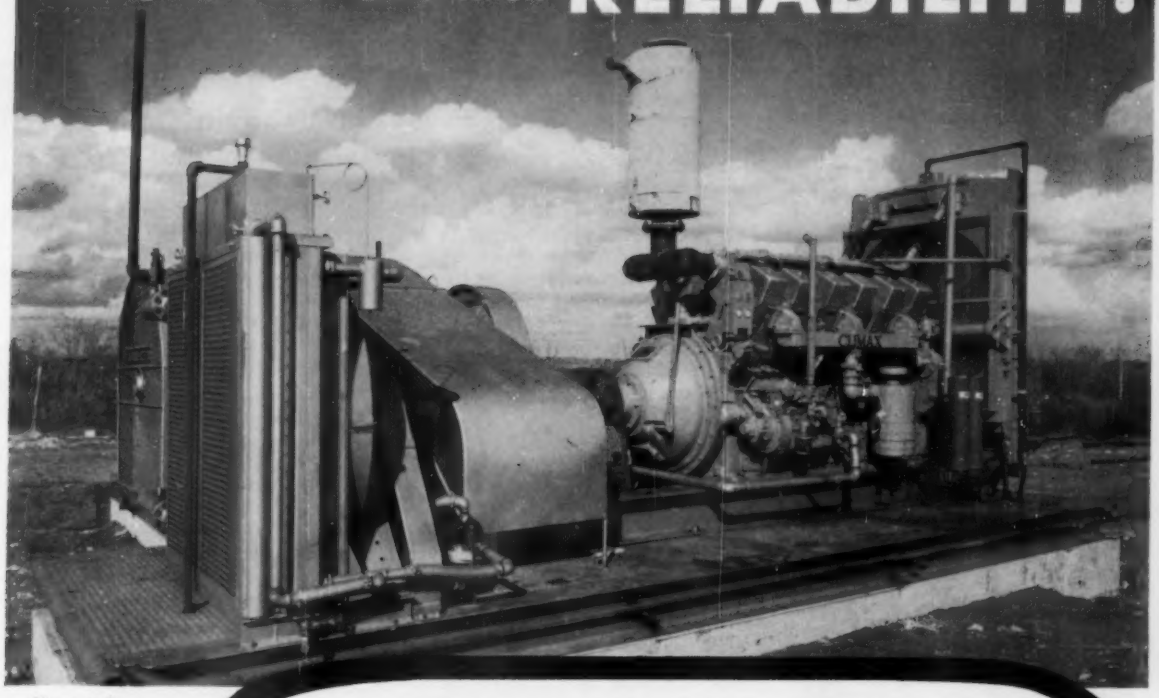

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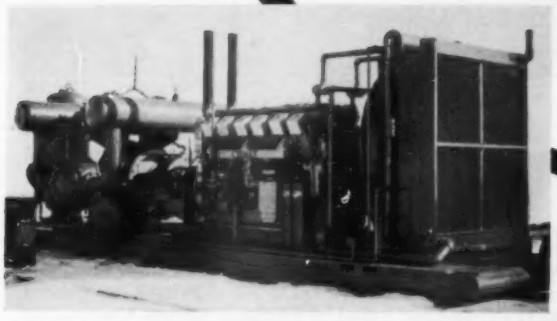

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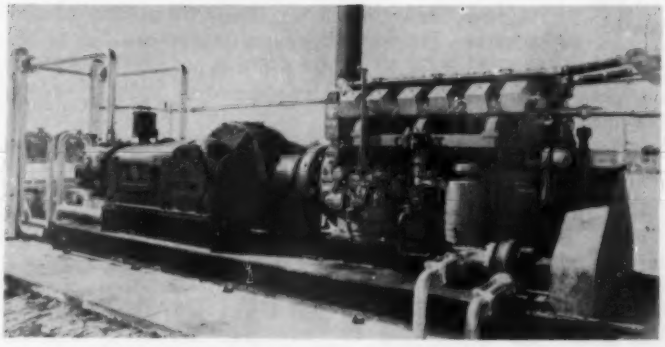

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Sinclair Oil & Gas Co. with production from the Arbuckle. Later, zones in the Pennsylvanian were tapped in development wells.

Major . . . The old, but recently revived Seiling area of Major County, gained a good extension test. Shell Oil Co. took open flow test at its 1-22 Louthan in SE NE SW 22-20n-16w, getting 12,400 M.c.f.d. of gas and 44.41 bbl. of distillate per million feet of gas, 61° gravity. Pay is the Mussellem sand at 6,956-74 ft.

Big push on way . . . These discoveries are merely a part of the rapidly growing campaign in the northwestern Anadarko basin—a five-state area. Wildcat locations have been announced for widespread areas of the Texas and Oklahoma Panhandles, northwestern Oklahoma, southeastern Colorado, northeastern New Mexico, and Southwest Kansas. One of the most aggressive programs will be in Kiowa, Prowers, and Baca counties in Colorado.

Important new tests are slated in Ochiltree, Lipscomb, and Hemphill counties, Texas; Hamilton and Stanton counties in Kansas, and Union County, New Mexico, not to mention widespread development plans for a new deep-producing area in northwestern Texas County, Oklahoma. Each year seems to be the biggest for this region, but signs point to 1959 as perhaps being its best yet.

San Juan basin adds three Dakota finds

The San Juan basin's Dakota Cretaceous push netted three good wells. Sunset International Petroleum Co. completed three wells in San Juan County, northwestern New Mexico.

The 1 Sipco Kutz Federal-A, NE SW 32-28n-10w, had calculated open flow of 6,814 M.c.f.d.; the 1-F well, SE NE 16-27n-10w, flowed 5,800 M.c.f.d. plus 80 bbl. of distillate per million. The 2 Sipco Kutz Federal-J, NW NE 6-27n-10w, made 2,251 M.c.f.d., plus 25 bbl. distillate per million.

Eastern Kentucky well taps Pennsylvania oil

On Bucks Branch in Magoffin County, Kytex Exploration Co. has completed 1 Proctor Wireman Heirs as a shallow Pennsylvanian salt sand gas producer. Bottomed at 770 ft., well flowed initially at the rate of 516 M.c.f.d. of gas.

These California spots make news:

San Emidio

A significant new pool discovery in the San Emidio Nose field of Kern County was reported by Richfield Oil Corp. in a wildcat ¾-mile northeast of the field discovery well. The new pool wildcat, 83-9 KCL-H, flowed at a daily rate of 1,700 bbl. on a 3-hour test of an interval at 12,702-12,838 ft. The producing sand is believed to be in the Miocene Stevens or its equivalent. Richfield was preparing to test water shutoffs before completing the well. Production in the discovery and the three development wells in the 9-months-old field comes from an upper Miocene Reef Ridge formation.

Posuncula

Shell Oil Co. moved back into two wells in the Posuncula area of the Strand field in Kern County and recompleted them in a shallower Stevens sand stringers for excellent production rates. Both are on the north edge of the pool.

One, 88-1 Posuncula KCL, was originally completed for 700 bbl. daily from 9,558-74 ft. It was recompleted at 8,435-60 ft. for 614 bbl. daily of 34.4°-gravity crude through a 20/64-in. choke.

The other, 28-6 Posuncula KCL, was originally completed 2 years ago at 9,534-87 ft. making 664 bbl. daily. It's recompletion production is 727 bbl. daily of 35.5°-gravity crude from 8,910-50 ft.

Beehive Bend

Drill-stem tests of an interval at 4,585-4,601 ft. indicated that a significant new gas pool discovery was assured in a wildcat being drilled by W. S. Payne, Jr. & Associates on the southwest flank of the Beehive Bend gas field in Glenn County.

The well, 1 Egelbert, flowed at a maximum rate of 7,200 M.c.f. through a 74/64-in. choke which was open 20 minutes. The operator planned to drill ahead below its present depth at 4,601 ft. to around 6,500 ft.

Los Angeles

Humble Oil & Refining Co. recently dually completed one of California's deepest active drilling projects. The Humble well, 63 N.L.&F., was drilled to 13,468 ft. and completed in intervals at 13,000-35 ft. and 13,188-13,228 ft.

Production from the upper zone was 240 bbl. daily of 27.6°-gravity crude through a ¼-in. choke. Lower zone production amounted to 139° bbl. daily of 24° gravity through a similar-size choke. This well is on the north edge of the Castaic Junction field in Los Angeles County.

San Joaquin

A wildcat drilled to 5,143 ft. at a site more than 1 mile northwest of production in the Vernalis gas field of San Joaquin County was abandoned by Great Basins Petroleum Co. This breaks a winning streak for Great Basins and Porter Sesnon who had run up a string of successful extensions and outposts in this hot gas area in Central California.

Deep test in Los Angeles field plugged back

Efforts to find deep production associated with the old Los Angeles oil field in metropolitan Los Angeles apparently have failed. Richfield Oil Corp. plugged back its 8,054-ft. wildcat on Sunset Boulevard, just 1½ miles north of the Los Angeles field to 928-1,009 ft. for a test of the old shallow zone. Production in the shallow zone dates back to 1892.

Four extensions feature Illinois play

Four extensions to oil pools were discovered in Illinois in February, according to the Illinois Geological Survey. There was one extension to Kincaid Consolidated and one to Mt. Auburn Consolidated in Christian County and two to Sailor Springs Consolidated pool in Clay County.

Kenner pool in Clay County and Omaha pool in Gallatin County had relatively high drilling activity in February, a continuation of development which began in 1958. The discovery in January of a 1½-mile southwest extension to Mt. Auburn Consolidated pool in Christian County has resulted in a flurry of drilling activity in that area.

Illinois oil production for February is estimated at 6,276,000 bbl., according to the Geological Survey.

Kansans find oil

New Pennsylvanian production is indicated at a northwestern Kansas wildcat. Amerada Petroleum Corp. reports recovery of 810 ft. of clean oil in 2 hours at its 1 Walters in NE NE SW 17-4s-33w, Rawlins County. Drill-stem test was in the Lansing-Kansas City. This hinted discovery is northeast of Sappa Creek field and west of Waterman field.

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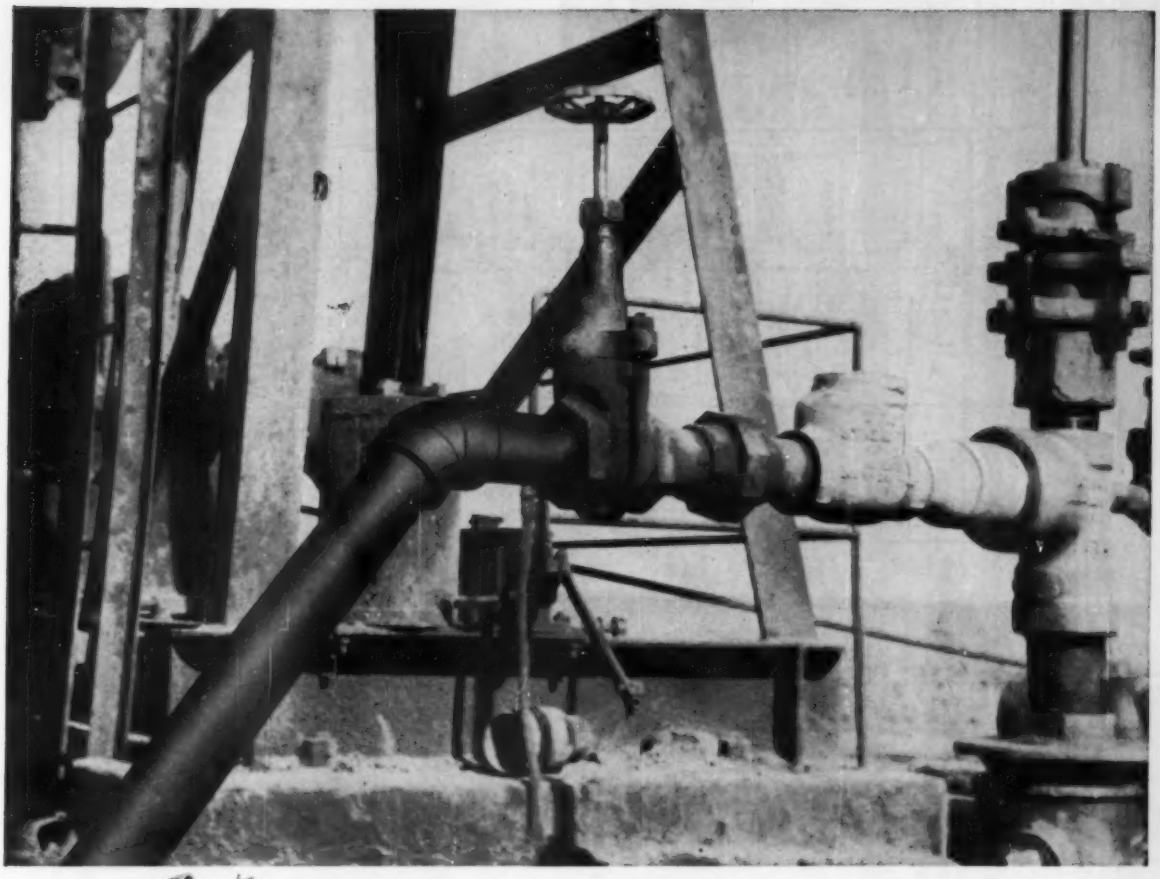

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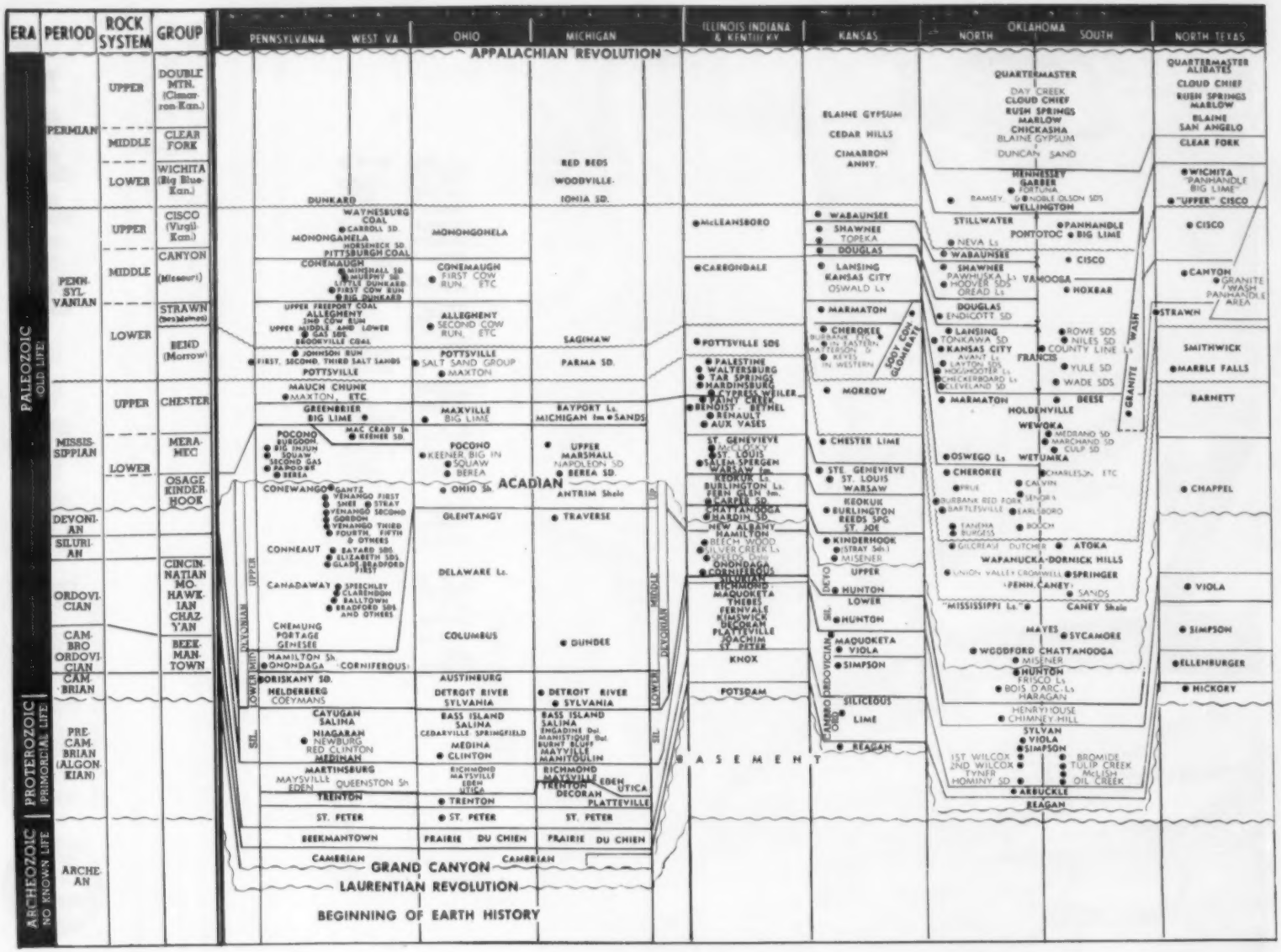

Ashtabula gas race continues

ACTIVITY in Ashtabula County, Ohio, continues as three Clinton gassers were reported as completed in North Central Monroe Township.

In Section 5, Biller & Flannagan 1 H. G. and E. Hicks logged the sand from 3,135-50 ft. and gaged 1,580 M.c.f. natural with rock pressure of 1,010 psi.

Russell McConnell reports two completions, 1 M. Pazdziorka, Section 4, logged the sand from 3,124-42 ft. and gaged 1,460 M.c.f. natural with rock pressure of 1,000 psi. The 1 C. R. Blake, Section 18, logged the sand from 3,102-17 ft. and had 90 M.c.f. natural and 433 M.c.f. after fracture with rock pressure of 910 psi.

Further extension to this gas pool is imminent as seven strings are now drilling in the general area.

Cedar Creek sees discovery comeback

THE INDICATED return to exploration on Montana's Cedar Creek anticline on the southwest side of the Williston basin paid off last week at The Texas Co.'s Dawson County wildcat, the 1 Guelff, SE NE 4-15n-54e.

Interlake Silurian production at this well made 438 bbl. of oil in 19 hours on 10/64-in. choke. Drill-stem tests were made earlier in the Silurian at 8,955-9,050 ft. Flow was at the estimated rate of 15 bbl. hourly. Two drill-stem tests in the Red River Ordovician got free oil on recovery.

Location of this promising new strike is 4½ miles northwest of Glendive field production.

Gas flows at old Washington well

Sunshine Mining Co. reported 1 Sampson Unit, which was originally drilled to 3,711 ft. in 1951 as 4 Hawksworth, flowed 1,497 M.c.f. of gas and 3½ bbl. of 56°-gravity condensate from an interval at 3,601-3,996 ft. on a 30-minute test through a 10/64-in. choke.

Sunshine went back into this old well, which was never on commercial production, to deepen it to the Nye zones of 1 Medina, Washington's only commercial well. Both wells are in 15-18n-12w in the Ocean City area of Grays Harbor County. Production in 1 Medina is coming from 3,952-58 ft.

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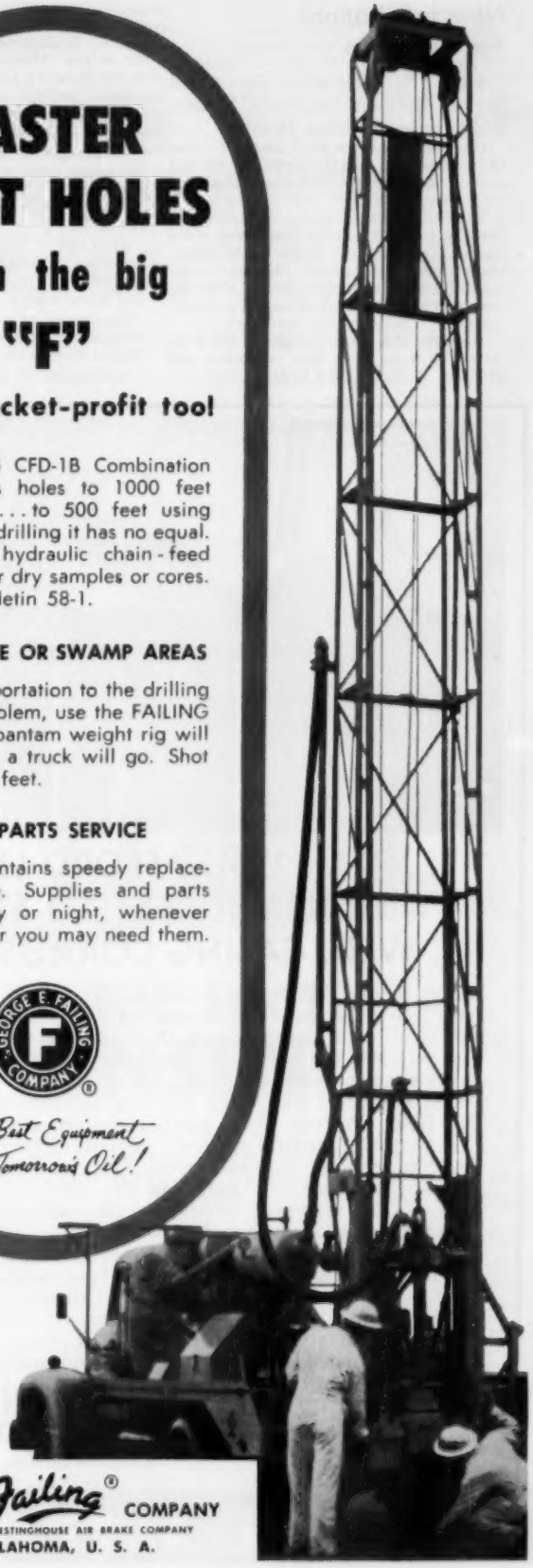

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New publications for oil finders

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Cross-sections upper Gulf Coast of Texas (four strike and two dip sections). Vertical scale 1 in. equals 800 ft. Horizontal scale 1 in. equals 16,000 ft.

HGS study group report, stratigraphy of the upper Gulf Coast of Texas, and strike and dip cross-sections of upper Gulf Coast. Approximately 50 pages. General discussion of tertiary formations, four foldout dip cross-sections, two foldout strike cross-sections.

Geologic strip maps. Highway 77 from Texas-Oklahoma state line to Dallas and Highway 75 from Dallas to Galveston.

Geologic strip maps. U. S. Highway 90 from Texas-Louisiana state line to Van Horn and U. S. Highway 80 from Van Horn to Texas-New Mexico state line. Available about June 1, 1959. Strip maps include culture, geologic formations which outcrop at surface, subsurface contouring and oil and gas field with pertinent data.

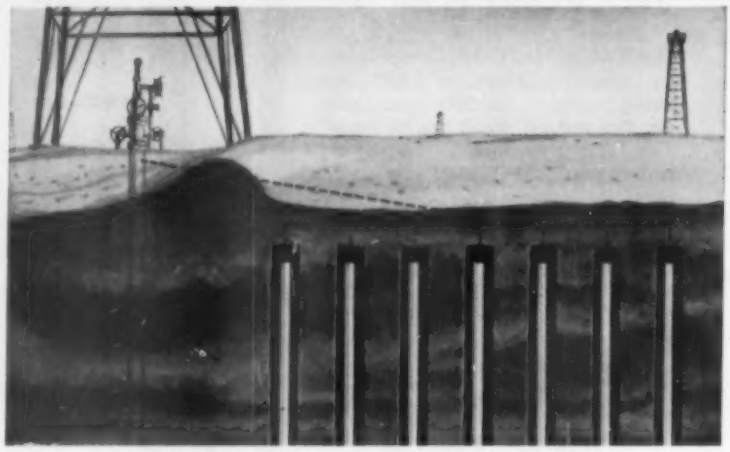
AAPG–SEPM–SEG Guidebook. General discussion, cross-sections, and structure maps of 23 Gulf Coast fields. Articles of six aspects of Gulf Coast geology. Itinerary of five field trips.

Directory of Houston Geological Society. Geophysical Society of Houston with photographs, and members' company affiliation and home address.

Guidebook of the annual field trip, HGS and SEPM, Upper and Middle Tertiary, Brazos River Valley, Texas.

Guidebook of Field Trip, HGS, Boling Dome, Wharton County, Texas. Includes cross-sections of flank of dome.

Houston Geological Society Bulletin. Includes abstracts of papers presented to the society. (Published September through June —10 copies.)



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Synthesis of organic compounds in the atmosphere of the primitive earth. Reactions of biochemicals during rock formation. Thermal alteration of chlorophyll. Bacterial activity in recent sediments. Petroleum genesis and accumulation mechanisms. The sedimentary strata as a chromatographic column. Nitrogen, noble gas and carbon isotope geochemistry. Recent U. S. and foreign developments in geochemical exploration for oil.

The deadline for papers is April 1, 1959. Inquiries should be addressed to the members of the program committee: Professor Bartholomew Nagy, Department of Chemistry, Fordham University, chairman; Dr. E. G. Baker, Esso Research & Engineering Co., P. O. Box 51, Linden, N. J.; Professor Paul A. Witherspoon, Department of Petroleum Engineering, University of California, Berkeley 4, Calif. The discussion moderator will be Dr. G. D. Hobson of the Imperial College of Science and Technology, University of London, England.

Although the symposium is not part of the official program of the Fifth World Petroleum Congress, Congress registrants may receive symposium information and preprints at the documents counter in the registration area at the New York Coliseum.

Discovery wells

ARKANSAS

Union County: C. G. Davis 2 Olin, C W½ NW NE 9-18s-14w. IP 76 BOPD, Tuscaloosa 3,065-70 ft., 28.5°. TD 3,237 ft. Discovery of Highbank Creek field.

WESTERN CANADA

Alberta: Pan American Petroleum Corp.-British-American Oil Co. A-35 Swan Hills, LSD 10, 28-66-10w5. Slave Point oil discovery. TD 9,020 ft.

Plymouth 6-20-67-22 Athabasca, LSD 6, 20-67-22w4. D1 gas discovery. TD 4,380 ft.

COLORADO

Adams County: Ancora Corp. and B. F. Allison 1 Midcap-Rugg, NE SE 19-1s-

57w. IP 7M.M.c.f.d., Shut-in gas discovery, "J" sand 5,787-91 ft., 5,770-74 ft. TD 5,804 ft. New pool.

LaPlata County: Lion Oil Co. (Monsanto) 1 Ada, SE NW SE 25-33n-11w. IP 668 M.c.f.d., Mesaverde gas discovery, new field. TD 8,060 ft. Dakota.

Logan County: Cabeen Exploration Co. 1 State "A", SE NW 34-11n-54w. IP 180 BOPD, 5,073-83 ft. TD 5,272 ft. New pool.

Montrose County: Kirby-Deyer 1 Government, 4-45n-16w. IP 630 M.c.f.d., Rico and Hermosa 4,174-5,206 ft. TD 7,144 ft. Coke Oven area discovery.

Morgan County: Far West Trading Co. 1-A Williams, NE SE 32-5n-60w. IP 384 BOPD, "D" sand 6,291½-95½ ft. TD 6,393. Dikes pool discovery.

Washington County: Dawson Oil Co. 1 Criswell, NE NE 8-4s-56W. IP 40 BOPD, 10 BWPD, "J" sand 5,158-70 ft. TD 5,284 ft. New extension.

Dawson Oil Co. 1 Barnes, NE SW 20-1s-56w. IPP 175 BOPD, "D" sand discovery, new field. TD 5,430 ft. "J" sand.

INDIANA

Gibson County: Messman-Webb 1 P. Woodburn, NW SW NW 2-2s-9w. IP 125 BOPD, Jackson sand 1,365-75 ft.; Aux Vases 1,578-80 ft. TD 1,585 ft. Discovery of Sandy pool.

KANSAS

Cheyenne County: Phillips Petroleum Co. 1 Wilkins "A," C E½ SE NW 16-2s-37w. IPP 83 BOPD, Cherokee 4,743-96 ft. TD 5,390 ft. Opens Ken field in Dodge City basin.

Lawton 1 Rueb, C SE NE 13-3s-42w. IPP 63 BOPD, Lansing 4,537-43 ft., 24.6°. TD 5,513 ft. Opens new field in Dodge City basin.

Rice County: Thunderbird Drilling Co. 1 Fair, SW NE SE 32-21s-9w. IPP 10 BOPD, Simpson sand 3,553-59 ft., 40.6°. TD 3,559 ft. Opens Northeast Wisby field in South Central Kansas basin.

Barber County: Harry Thompson and Ted Bear 1 Eads, NE NE NE 4-30s-14w. IP 120 BOPD, 34°, Simpson 4,561-70 ft. TD 4,520 ft. New field.

Barton County: Thomas Allan 1 Stiles, SW¼ 7-16s-12w. IP 51 BOPD, 34°, Arbuckle 3,345-47 ft. TD 3,357 ft. New pay in Stiles pool.

Nadel & Gusman 1 Burmeister, NW SE SW ?-19s-11w. IP 25 BOPD, Douglas 2,982-88 ft. TD 3,380 ft. Burmeister pool discovery.

Clark County: Pure Oil Co. 1 C. H. Tuttle "D," C NW NW 8-35s-22w. IP 1,467 M.c.f.d., Morrow 5,630-38 ft., 5,672-78 ft. TD 5,937 ft. New field.

Ellis County: Leo E. Dreiling 1 Dreiling "F," SW NE SE 3-12s-16w. IP 114 BOPD, 37°, Arbuckle 3,294-3,306 ft. TD 3,360 ft. New pay in Northwest Blue Hill pool.

Edwards County: D. R. Lauck 1 McClanahan, SE SE SW 2-26s-18w. IP 79 BOPD, 79 BWPD, 37.3°, Mississippian 4,612-16 ft. TD 4,846 ft. McClanahan pool discovery.

Graham County: Kimbark 1 Brungardt, SE SW NE 6-10s-25w. IP 198 BOPD, 52 BWPD, 33°, Lansing 4,029-32 ft. TD 4,438 ft. New pay in Gra-Sher pool.

Woodman-Ianitti et al. 1 Robinson, SE SE SW 18-10s-22w. IPP 81 BOPD, Marmaton 4,036-40 ft., 29°. TD 4,108 ft. Opens Robin field on Central Kansas uplift.

Murfin et al. 1 Diebolt, NW NW NW 14-10s-23w. IPP 179 BOPD, Lansing 3,817-27 ft., 34°. TD 4,085 ft. Opens East Hoof field on Central Kansas uplift.

Haskell County: Northern Natural Gas Co. 1 Sprunger "C," C SE SW 20-28s-34w. IP 1,800 M.c.f.d., 8 BOPD, 8 BWPD, 46°, Marmaton 4,699-4,700 ft., 4,709-16 ft. TD 5,448 ft. New pay in Eubank field.

W. J. Coppinger 1 Koenig, C NE NW 12-29s-34w. IP 50 BOPD, 7 BWPD, 29.2°, Morrow 5,294-5,301 ft., 5,314-19 ft. TD 5,650 ft. New field.

Hodgeman County: Kewanee Oil Co. 1 Herman, SE NE NW 7-21s-24w. IP 76 BOPD, 38°, Mississippian 4,391-96 ft. TD 4,479 ft. New pool.

Kingman County: Sunray Mid-Continent Oil Co. 1 Lucy Stucky, SE SE NW 1-27s-8w. IP 113 BOPD, 20 BWPD, 41°, Lansing 3,652-55 ft. TD 4,334 ft. Smoots Creek discovery.

Meade County: Skelly Oil Co. and Shamrock Oil Co. 1 J. H. Borchers, C NE SW 21-33s-28w. IP 740 M.c.f.d., Morrow 5,719-21 ft. TD 6,135 ft. New field.

1 D. E. Thiessen, NW NW SE 8-33s-27w. IP 2,740 M.c.f.d., Morrow 5,690-92 ft., 5,695-99 ft. TD 5,840 ft. New field.

Reno County: Globe 1 Edward Drake "B," SE SE NW 19-22s-9w. IP 211 BOPD, 43°, Simpson 3,637-50 ft. TD 3,755 ft. New pay in South Wisby pool.

Sheridan County: W. W. Sauvage 1 Transue, SE SW SE 18-9s-26w. IP 125 BOPD, 4 BWPD, 40°, Lansing 3,861-63 ft., 3,866-70 ft. TD 4,030 ft. New pay in Southwest George pool.

Stevens County: Panhandle Eastern Pipe

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Line Co. 1-7 Perrill, C NW NW 7-31s-37w. IP 26,498 M.c.f.d., Council Grove 2,804-10 ft., 2,826-29 ft., 2,874-84 ft.; Morrow 5,326-5,330 ft. TD 5,900 ft. New pay in Panoma field.

Hugoton Production Co. 2-29 Grubbs, C NW NW 29-31s-37w. IP 7,418 M.c.f.d., Council Grove 2,834-2,980 ft. TD 6,005 ft. New field.

KENTUCKY

Daviess County: Basin Drilling Co. and Cox Drilling Co. 1 Homer Gordon, 13-O-27. IP 75 BOPD, Bethel 1,908-24 ft. TD 1,924 ft. Discovery of Raphael pool.

LOUISIANA OFFSHORE

Eugene Island Area: Continental Oil Co. (CATC Group) 2-A OCS-0576, Blk. 208, Eugene Island Area, Gulf of Mexico. IP 352 BOPD, 8/64-in., 34.4°, TP 3,100 psi., GOR 721 cu. ft. per barrel, perf. 10,029-34 ft. TD 12,020 ft. New pay in Eugene Island Blk. 208 field.

NORTH LOUISIANA

Caldwell Parish: Barnwell Drilling Co. 1 Olin Mathieson Chemical Co., SWc 23-15n-2e. IP 4,425 M.c.f.d., Rodessa 6,637-42 ft. TD 6,686 ft. New pay in Vixen pool.

W. C. Feazel Interests and Sunray 1 Lee English, C NE 33-22n-12w. IP 517 M.c.f.d., Smackover Gray sand 11,598-11,618 ft.; 11,635-44 ft. TD 11,952 ft. Rocky Mount pool discovery.

Catahoula Parish: Jett Drilling Co. 1 Louisiana Central Minerals "B," SEc SE SW 2-10n-5e. IP 160 BOPD, 41.5°, Tuscaloosa 7,806-13 ft. TD 7,943 ft. Opens Enterprise pool.

A. J. Hodges Industries 3 Louisiana Central Lumber Co. "A," NWc SE SW 17-10n-6e. IP 128 BOPD, 41.5°, Tuscaloosa Massive sand 7,973-78 ft. TD 8,100 ft. Opens Prichard field.

LaSalle Parish: Justiss-Mears Oil Co. 1 Louisiana Delta Corp. "B," SWc 13-6n-4e. IP 104 BOPD, 30 BWPD, 42°, Wilcox 4,302-06 ft. TD 5,012 ft. Opens South Cypress Bayou field.

Red River Parish: Alec Crowell 2 J. K. Graham, SWc NE SE 29 in 20-11n-9w. IP 1,200 M.c.f.d., Paluxy 3,012-14 ft. TD 5,469 ft. New pay in Paluxy Lake End pool.

SOUTH LOUISIANA

Calcasieu Parish: California Co. 1 Stine & Kinney, 10-11s-11w. IP 120 BOPD, 4,880 M.c.f.d., 16/64-in., 53.8°, TP 3,800 psi., perf. 9,124-55 ft. TD 12,043 ft. Second well and new pay in Choupique field.

MONTANA

Musselshell County: D. A. Jenks and Potter 1 Monada-Petoja, 14-11n-24e, IP 20 BOPD, 70 BWPD, 23°, Van Dusen 1,074-81 ft., 1,114-21 ft. TD 1,289 ft. Discovery in Devil's Basin area.

NEBRASKA

Cheyenne County: Chandler & Simpson 1 Stanley, SE SW 18-16n-51w. IPP 57 BOPD, "J" sand 5,234-46 ft., "J" sand discovery, new field. TD 5,310 ft. Skull Creek.

WESTERN NEBRASKA

Banner County: W. R. Weaver 1 Huffman, C SE SW 15-17n-55w. IP 143 BOPD, "J" sand 6,313-18 ft. TD 6,407 ft. Discovery well of new pool.

Kimball County: Shoreline Petroleum Corp. 1 Spath, C NE SE 2-13n-55w. IP 190 BOPD, "J" sand 6,251-62 ft. TD 6,277 ft. Spath pool discovery.

Viking Oil Co. 1 Reeves, C NW NE 35-13n-56w. IPP 150 BOPD, "J" sand discovery, new field. TD 6,723 ft. "J" sand.

Morrill County: Nebraska Drillers and Mar Oil Co. 1 Stark, C SW SW 5-17n-51w. IP 120 BOPD, "J" sand 5,203-06 ft. TD 5,263 ft. Opens Mar field.

NORTHWEST NEW MEXICO

San Juan County: Pan American Petroleum Corp. 83 Gallegos Canyon Unit, SW NE NE 26-28n-12w. IPF 267 BOPD, Gallup; IP 1,250 M.c.f.d., Dakota, Gallup discovery, new field. TD 6,343 ft. Dakota.

SOUTHEAST NEW MEXICO

Lea County: Santiago Oil & Gas Co. 1-30 State, 30-12s-34e, 12 miles west of Tatum. Dual completion. IP 288 BOPD, 18/64-in. choke, 45°, GOR 477:1, TP 400 psi., Pennsylvanian 10,218-68 ft.; IP 438 BOPD, 18/64-in. choke, 58°, Devonian 12,899-12,924 ft. TD 13,103 ft.

NORTH DAKOTA

Bottineau County: Amerada Petroleum Corp. 1 Gerald Stair, C SE SE 28-161n-79w. IP 17 BOPD, 8 BWPD, 36.2°, Spearfish 3,368-83 ft. TD 3,462 ft. New field.

American Royalty 1 McDougall Estate, C NE NE 19-163n-80w. IP 22 BIPD. 4.5 BWPD, 36°, Spearfish 3,395-3,407 ft. TD 3,583 ft. New pool.

Burke County: Stewart Petroleum Co. 1 Olson, C SW NE 3-160n-94w. IP 105 BOPD, 178 BWPD, 41.3°, Nesson-Iverson 7,776-78 ft. TD 7,919 ft. New field.

Williams County: Amerada and Hunt 2 North Dakota, C NE NW 16-158n-95w. IP 277 BOPD, 44 BWPD, 39.8°, Duperow-Devonian 9,980-10,012 ft., 10,020-74 ft. Discovery in Tioga area.

OKLAHOMA

Ellis County: Odessa Gasoline Co. et al. 1 Potter Unit, C SE NW 12-19n-22w. IPP 151 BOPD, 40°, Cottage Grove Pennsylvanian 7,980-94 ft. TD 11,237 ft. New oil field.

NORTH TEXAS

Montague County: Marshall Pipe & Supply Co. 1 M. M. Gilbert, M. A. Newton Sur., A-569, 4 miles northeast of Nocona. New pay discovery in Haralman field. IPP 50 BOPD, 39°, GOR 400:1, lower Strawn 4,630-35 ft. TD 4,663 ft., elevation 862 ft.

Petroleum Investment Co. 1 R. Hynds "B," J. J. Wall Sur., A-1199, 9 miles north of Nocona. New pay in Montague County Regular field. IP 3,600 M.c.f. of gas, open flow, Stray sand 1,500-15 ft. Shut-in pressure 511 psi. TD 1,999 ft.

Wise County: Christie, Mitchell & Mitchell 1-C Houston, Sec. 5, Falls CSL Sur., A-293, 1¼ miles southeast Park Springs. New pay in Sancree (Bend) field. OWDD, old TD 4,746 ft. IP 1,680 M.c.f. of gas open flow, GOR 112,000:1, shut-in pressure 1,450 psi. New TD 5,850 ft.

Young County: Norman & Johnson 1 T. J. Routon, Sec. 736, TE&L Sur., 8 miles southwest Newcastle. IP 96 BOPD, 16/64-in. choke, 41.6°, GOR 400:1, TP 195 psi., Strawn 3,520-36 ft. TD 3,585 ft., elevation 1,175 ft.

SOUTHWEST TEXAS

Val Verde County: Deane H. Stoltz 2 Glasscock, Sec. 6, Blk. G, GWT&P Sur. IPP 1.66 BOPD, 18°, perf. 332-34 ft., Paluxy. TD 350 ft. Revives and extends Rehders field.

TEXAS GULF COAST

Bee County: Siznod Oil Corp. 1 Macdon Roy. Corp., James York Sur., A-333, 8 miles northwest of Beeville. IPP 43.34 BOPD (net), 11% water, 46.8°, perf. 4,234-36 ft., Pettus, TD 4,550 ft. New field.

Paul J. Fly 1 Imogene Hall, J. W. Williamson Sur., A-321, 2 miles southwest of Pettus. IPP 24.36 BOPD (net), 60% water, 24°, perf. 2,708-11 ft., upper Eocene. TD 4,200 ft. New field.

Calhoun County: Humble Oil & Refining Co. 1 Daniel Schicke, James Hughson Sur., A-23, 6 miles east of Olivia. AOF 32 M.M.c.f.d., GLR 29.5 M.c.f. per barrel, 48.9°, shut-in TP 5,306 psi., perf. 7,859-89 ft., Frio-Broughton. TD 12,000 ft. New field—Southeast Appling.

DeWitt County: Yorktown, Ltd., 1 Boldt, C. G. H. Woods Sur., A-482, 2½ miles east of Yorktown. AOF 2,570 M.c.f.d., GLR 27.8 M.c.f. per barrel, 62.8°, shut-in TP 1,934 psi., perf. 7,108-19 ft., Wilcox. TD 7,315 ft. New pay in Yorktown field.

Chambers County: J. P. Petkas et al. 1 A. L. Miller et al. Gas Unit, S. Barrow Sur., A-37, 5 miles southeast of Mount Belvieu. AOF 15,500 M.c.f.d., GLR 76 M.c.f. per barrel, 59°, shut-in TP 2,835 psi., perf. 8,370-76 ft., Frio. TD 8,470 ft. New reservoir southwest of South Cotton Lake field and northwest of West Trinity Bay field.

Galveston County: Texas Eastern Transmission Co. 1 Sadie Henck, Blk. 38, L. M. Hitchcock Subd., William H. Zack Sur., A-13 AOF 4,050 M.c.f.d., 67.89 BC per M.M.c.f., 49.3°, shut-in TP 7,900 psi., perf. 12,834-42 ft., Frio. TD 15,907 ft. Extension and new-pay discovery in Hitchcock-Alta Loma-Sarah White area.

Harris County: Spring Oil & Gas Co. 1 Tesar et al., Reels & Trobough Sur., A-59, 5 miles east of Houston. AOF 10 M.M.c.f.d., dry gas, shut-in TP 840 psi., perf. 3,664-74 ft., Miocene. TD 6,869 ft. New pay in Clinton field.

Live Oak County: Refugio Enterprises, Inc., 2 Linkenhoger, Sec. 112, M. M. Shipp Sur., A-814, 5 miles east of Dinero. AOF 2,100 M.c.f.d., GLR 32.2 M.c.f. per barrel, 50.5°, shut-in TP 2,211 psi., perf. 6,098-16-6,106 ft., Yegua. TD 6,267 ft. New field—East Swinney Switch.

WEST CENTRAL TEXAS

Callahan County: Paramount Oil, Inc., 1 H. D. Gray, R. R. Puckett Sur. 770, 1 mile northeast of Cross Plains. IPP 77 BOPD, 43°, GOR 1,301:1, Ellenburger 3,729-45 ft. TD 3,745 ft., elevation 1,778 ft.

Coleman County: Bryce McCandless 1 B. D. and Macon Richmond, W. Faris Sur. 279, 8 miles south of Santa Anna. IP 62.5 BOPD, 6/64-in. choke, 42°, GOR 1,232:1, TP 175 psi., pay 1,465 ft. TD 1,567 ft.

Palo Pinto County: Skelly Oil Co. 1 Rhodes, 11-1-T&P Sur., 3½ miles northeast of Palo Pinto. IP 4,900 M.c.f. of gas, plus 38 bbl. condensate, 75.9°, GOR 32,000:1, Marble Falls 4,254-68, 4,313-17 ft. TD 5,080 ft.

Stephens County: Wright, Clark & Senkel 1 Puckett, Jose Malona Sur., 8 miles south of Woodson. IP 242 BOPD, 16/64-in. choke, 41°, GOR 1,250:1, TP 410 psi., Mississippian 4,252-4,382 ft. TD 4,440 ft., elevation 1,138 ft.

Stonewall County: Lone Star Producing Co.

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1 Lackey, 95-D-H&TC Sur., 1½ miles northeast of Link (Canyon reef) field. IPP 10 BOPD, 38.8°, GOR 288:1, Canyon sand 4,754-62 ft. TD 5,000 ft.

Taylor County: Daya Operating Co. 4-B Ailene Johnson, G. W. Denton Sur. 446, 4 miles southwest of Lawn. IPP 72 BOPD, 40°, GOR 291:1, McMillan sand 2,775-91 ft. TD 2,791 ft.

J. R. McLean et al. 1 Leslie, 147-64-H&TC Sur., 3 miles northeast of Shep. IP 127 BOPD, 12/64-in. choke, 41°, GOR 957:1, TP 340 psi., pay 4,661 ft. TD 4,780 ft.

Roark, Hooker & Hill 1 J. A. Hawkins, W. Harris Sur. 405, 2 miles east of Ovalo. IPP 81 BOPD, 39°, GOR 560:1, McMillan sand 2,738-41 ft. TD 2,761 ft.

WEST TEXAS

Borden County: Midwest Oil Corp. 1 G. A. Milliken, 476-97-H&TC Sur., 18 miles northeast of Gail. Dual completion. IP 218.6 BOPD, 22/64-in. choke, 43°, GOR 755:1, TP 100 psi., Strawn 7,856-64 ft.; IPP 37 BOPD, 40°, Ellenburger 8,309 ft. TD 8,316 ft., ground elevation 2,359 ft.

Crockett County: Fair Oil Co. 2 Maggie Neal, 2-A-BS&F Sur., 14 miles south of Big Lake. IPP 8 BOPD, 36°, pay 2,388 ft. TD 2,512 ft.

Garza County: M. R. Voltz et al. 1 Wheeler, 20-B9-F. Bathwell Sur., 13 miles north of Post, San Andres discovery in Forbes-Glorietta field. IPP 108 BOPD, 39°, GOR 800:1, San Andres 3,031-90 ft. TD 3,850 ft.

Pecos County: Standard Oil Co. of Texas 1 Southland Royalty, 76-11-H&GN Sur., 10 miles southeast of Girvin. IP 14,250 M.c.f. of gas, calculated open-flow, Wolfcamp 4,968-5,364 ft. TD 5,391 ft., elevation 2,781 ft.

UTAH

Uintah County: Gulf Oil Corp. 2 Wonsits-Federal, NE SW 29-7s-22e. IPP 210 BOPD, 10 BWPD, Green River discovery, new pay. TD 6,192 ft. Green River.

WYOMING

Campbell County: True Oil Co. 1-16 T.C.-State, C NW NW 16-49n-70w. IP 48 BOPD, 12 BWPD, 25.2°, Minnelusa 9,360-80 ft. TD 9,547 ft. New discovery of Timber Creek field.

Hot Springs County: Ohio Oil Co. 4 Unit, NW¼ 19-46n-98w. IP 300 BOPD, Darwin 4,418-40 ft., 4,386-90 ft. TD 4,630 ft. New pay in Grass Creek field.

Lincoln County: Belfer Natural Gas No. 2 Unit, 20-22n-112w. IP 3,200 M.c.f.d., Second Frontier sand 10,818-10,920 ft. TD 11,012 ft. New field.

Pan American 2 Unit, SE NW NW 11-24n-114w. IP 129 M.c.f.d., Fort Union 2,968-76 ft. 3,124-38 ft. TD 3,651 ft. Bridger Basin discovery.

Belfer 1 C.P.-BNG-Lasson McGinnis, 7-26n-112w. IP 8,100 M.c.f.d., First Frontier 7,015-40 ft., 7,051-67 ft., 7,084-7,172 ft.; Second Frontier 7,313-44 ft., 7,369-93 ft. TD 7,570 ft. Gas discovery.

Sweetwater County: Caulkins Oil Co. 4-88 Government, SW SW 8-15n-103w. IP 57 BOPD, 6 BWPD, 41.6°, Dakota 4,906-4,109 ft. TD 5,056 ft. Rock Springs uplift area discovery.

Sublette County: Belfer 31 BNC-Beneficial, 21-27n-112w. IP 8,100 M.c.f.d., Second Frontier 7,100-46 ft., 7,180-7,226 ft., 7,361-73 ft., 7,393-7,428 ft. TD 7,973 ft. New field.

St. Louis Car Co. 1 Government, NW NW 30-27n-110w. IP 2,200 M.c.f.d., Fort Union gas discovery, new field. TD 7,347 ft. Hilliard transition.

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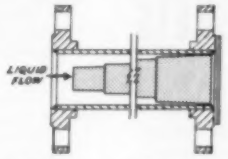

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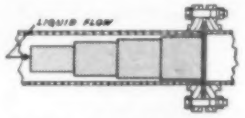

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Pipeliner McGee Moves Up

. . . in Tennessee Gas to head firm's biggest division. His long suit is a knack for getting along with people.

WALTER Claude McGee, Jr., better known as "Maggie" to the pipeline industry, considers himself a very lucky fellow.

Back in 1944, most of his friends advised him against throwing away 13 years of seniority in a thriving pipeline company in Omaha just because a new war baby down in Texas wanted him to go to work.

But McGee's chief boss, mentor, and great friend, Stacy W. Taft, bucked the trend and told him to strike for bigger things in a new outfit that offered unlimited opportunities for advancement.

That's how "Maggie" McGee landed with the infant Tennessee Gas Transmission Co. at Houston and started on the road to the presidency of Tennessee Gas Pipeline Co., the division of Tennessee Gas which operates its natural-gas transmission facilities.

"A lot of people succeed because they're at the right place at the right time," McGee says.

McGee's modesty and easy-going approach belie the real man. Certainly there was a bit of luck in the fact that he joined the mammoth Tennessee Gas organization in its early days and moved swiftly ahead with it. But his advancement was much more than simple good fortune.

His associates are often astonished at the ease with which he handles a big complicated job—his capacity for handling details, for making quick decisions, and getting them executed.

If there is any real key to his success, it's his ability to get along with people. His own philosophy on this score: "No person can handle any supervising job by himself. He has to have people to help him. The best thing a company can have is good employe relations."

The start . . . The future builder of pipelines was born the son of a country banker in 1910 in Dodd City (population 500), 5 miles east of Bonham, Tex.

He went to grade school at Dodd City, high school at Bonham, and in 1927 entered Texas A. & M. to study civil engineering.

In 1931 he left college to work as a construction hand on a pipeline at Greensburg, Kans., and after 9 months went to work for the pipeline's owner, Northern Natural Gas Co., as a compressor-station operator in Greensburg.

Five years later, he moved up the ladder to the home office in Omaha and in 1937 was promoted to chief dispatcher.

He recalls with great fondness three men who helped him in his Northern Natural days: his Greensburg station superintendent, J. H. Goughnour; Stacy Taft; and the man who really changed his life, J. P. Bristow, at one time with Northern and formerly a vice president of Tennessee Gas, who prevailed on McGee to come down to Houston.

Up to now . . . Tennessee Gas was organized in September 1943 and began construction of its first big line, from South Texas to Charleston, W. Va., in December.

McGee came back to his home state in August of the following year and was on hand to take over as chief dispatcher at Houston when the line began operating Oct. 31, 1944.

From then on, McGee's rise was as rapid as that of the new company. By 1946 he was assistant to the operating vice president and by 1948 was chief engineer. In October 1949 he was named general superintendent of operations and in 1951 was elevated to a vice presidency. In 1954 he became a senior vice president, responsible for operations, maintenance, and engineering.

A few months ago, when Tennessee gas decided to realign its administrative structure in keeping with its swift growth, it was only natural that McGee should become president of its pipeline division.

As in the old days at Northern Natural, McGee is still inclined to give credit to others for his success at Tennessee Gas. And it's no surprise that he pays top tribute to the dynamo that has powered his company to a top-rank position in gas transmission — Gardiner Symonds, board chairman and president.

"Just being around him, I've learned more from him than from anyone else," McGee says. "Some of his personality and drive has rubbed off. He delegates authority and forgets about it; he lets you do it your way. He's looking for the end results."

And that's pretty much the way McGee operates his own end of the business.

●

Tom O'Neill, geologist with Shell Oil Co. in Long Beach, Calif., has been transferred to Ventura, Calif., and promoted to Ventura district geologist. He succeeds **Adrian Maaskant,** who was recently transferred to Sacramento, Calif. **Fritz Loomis,** Sacramento district geologist, has been transferred to Los Angeles.

▶ ▶ ▶ Personals

Carl G. Drescher, vice president of Sinclair Oil Corp., has been named president of Sinclair & BP Sales, Inc., new company owned jointly by Sinclair and British Petroleum Co., Ltd. **Robert D. Hill,** former operations manager of BP Trading, Ltd., has been elected senior vice president of the new company. Sinclair and BP

DRESCHER

HILL

organized the company to handle sales of Middle East and Venezuelan crude in the Western Hemisphere. Other officers include **William F. Farrell,** former corporate sales relations manager for Sinclair Refining Co., vice president and general sales manager, and **Wayne Templer,** assistant to the purchasing agent in New York for BP Trading, assistant general sales manager. **Jack Corlew,** assistant manager of Sinclair Refining's Sinclair, Wyo., refinery, will be planning director. Drescher joined Sinclair in 1956 after his retirement as a rear admiral in the U.S. Navy. He was named a vice president in 1957 to direct foreign operations, exclusive of Venezuela, and the purchase and sale of foreign crude.

J. H. Corbitt has joined the technical division at Humble Oil & Refining Co.'s Baytown, Tex., refinery. **H. L. Bauni, Jr.,** has returned to Baytown after military service. Both are in the distillation section.

R. D. Hanley, vice president and manager of Magnolia Petroleum Co.'s natural-gas department, will be in charge of the company's new petroleum chemicals department. Formation of the department follows announcement that the world's largest ethylene plant will be built at Magnolia's Beaumont, Tex., refinery.

Glenn E. (Buck) Buchanan, manager of refinery construction for Bechtel Corp., has been elected a vice president of Bechtel International Corp. **T. W. Moran** succeeds Buchanan in refinery construction. **W. L. Kennedy, Jr.,** has been named chief construction engineer in the pipeline division's construction group.

G. D. Thomas, area geologist in New Orleans for Shell Oil Co., has retired after 34 years with the company.

Troy A. Myers, Mid-Continent division manager for Sinclair Pipe Line Co., has retired.

N. L. Lang, junior petroleum engineer with Amerada Petroleum Corp., has been transferred to Bloomington, Tex., from Fairbanks, Tex.

Frank S. Giles, engineer in Pure Oil Co.'s production department, has retired. Giles joined Pure as a civil engineer in 1918.

Zachary B. Jones, district landman, and **C. W. Robinson,** subsurface geologist for Delhi-Taylor Oil Corp., have been transferred to Denver from Farmington, N. M. The move makes Denver district exploration headquarters in the Rocky Mountain area.

F. H. Frangenheim has been managing director of Anglo-Egyptian Oilfields, Ltd. He is heading a staff returning to Cairo from London to take over management of the company which was sequestered by the Egyptian Government 2 years ago.

Gordon E. Hillhouse, district engineer at Corpus Christi, Tex., for Sunray Mid-Continent Oil Co., has been named to the new post of administrative assistant to **R. E. Foss,** senior vice president. **Everett L. Smith,** coordinator of training in the employe relations department, has temporarily been named training supervisor in the production department, also a new post. Duties of two Sunray staff members have been realigned as part of a production department decentralization program. **L. G. Rodgers,** head of the gas division, has been named manager of engineering for production. **R. W. Griffith,** manager of unitization operations, has been appointed manager of unitization and gas sales.

Carl J. Hauck, general superintendent of production for Ohio Fuel Gas Co., has been promoted to assistant manager of the production department. Hauck joined Ohio Fuel in 1919. He had been southern district production foreman and supervisor of underground storage before being named general production superintendent in 1951.

C. W. Lutz, coordinator of Gulf Oil Corp.'s planning and economics department since 1956, has been promoted to director of the department. He succeeds **P. H. Bohart,** who was recently named administrative vice president and coordinator of the crude-oil department. Lutz joined Gulf in 1950 in Houston. He was director of purchases and administrative coordinator of the production department before being assigned to the planning and economics department.

LUTZ

H. G. Sehnert, Jr., has been named exploration manager for Sohio Petroleum Co. in Calgary. He will continue as assistant district manager there. **Clayton W. Nygaard,** staff assistant to the division superintendent in Billings, Mont., has been transferred to Calgary as assistant district superintendent of operations. In other changes in Sohio's northwest division, **Roy C. Gould,** senior engineer at Calgary, has moved to Billings as division reservoir engineer. **William L. Holloway,** geophysicist at Billings, has been transferred to Casper, Wyo., in the same capacity.

W. H. Litchfield, superintendent of the petrochemical department at Gulf Oil Corp.'s Port Arthur, Tex., refinery, has been promoted to superintendent of the refinery processing division. **W. S. Bonnell,** superintendent of the cracking department at Port Arthur, has been named superintendent of the chemical processing division. **J. A. Burns,** assistant superintendent of the cracking department, has moved up to superintendent, succeeding Bonnell. In other changes, **T. J. Dupy,** assistant supervisor of the petrochemical department, has been transferred to the gas and heavy chemical department and promoted to superintendent. **Leon Lusk, Jr.,** assistant superintendent of the light oil department, has been named to succeed Burns as assistant superintendent, cracking department. **B. P. Brown,** general operations foreman in the lubricating department, replaces Lusk in the light oil department. **P. L. Morgan,** assistant general foreman in the alchlor department, will become assistant superintendent of the gas and heavy chemical department. In the lubricating department, **R. D. James, Jr.,** assistant foreman, has been promoted to general operations foreman, succeeding Brown.

▶▶▶ Personals

Fred G. Crosby, general sales manager for Sun Oil Co., Ltd., has been elected a director.

George L. Cutsinger has joined Brantly Drilling Co., Inc., in Midland, Tex., as engineer.

Owen Snow, Jr., formerly district petroleum engineer for Colorado Oil & Gas Corp. in Wichita, Kans., has opened consulting offices in Wichita.

James H. Ogg has been promoted to manager of Texas Gulf Sulphur Co.'s Houston geological department.

C. L. Burrill, chief economist of Standard Oil Co. (N. J.), and **H. W. Fisher,** joint managing director of Iraq Petroleum Co., have been nominated for membership on the Jersey Standard board. New directors will be elected at the company's annual meeting May 27. Burrill and Fisher

BURRILL

FISHER

would fill vacancies on the board caused by resignation of **Arthur T. Proudfit** to become president of Creole Petroleum Corp. and the retirement of **H. H. Hewetson.** Burrill is a former vice president of Creole. Fisher has held posts with the Jersey companies as a director of Esso Standard Oil Co., coordinator of refining for Jersey's world-wide refinery operations, shareholders' representative in the United Kingdom, and chairman of the coordination committee for Europe. He has been on the IPC board since 1957.

E. C. Babson, Union Oil Co. of California's Calgary division manager, has been elected chairman of the board of governors of the Canadian Petroleum Association. He succeeds **R. A. Cruickshank,** Canadian Devonian Petroleums, Ltd., Regina. **C. E. Leach,** Tidewater Oil Co., Regina, was elected first vice chairman, and **A. O. Detmar,** Mobil Oil of Canada, Ltd., Calgary, was named second vice chairman. Elected to the board of governors were Detmar, **V. H. Hunter,** Imperial Oil, Ltd., Regina; **C. S. Lee,** Western Decalta Petroleum, Ltd., Calgary; **W. D. C. Mackenzie,** Imperial, Calgary; and **J. B. Webb,** Canadian Oil Companies, Ltd., Calgary.

Stanley O. Hutchison, engineer with Standard Oil Co. of California, has been transferred to Avenal, Calif., from Taft, Calif.

Arthur R. Atkinson has joined the production and exploration department of Monsanto Chemical Co.'s Lion Oil division. He is a recent graduate of the University of Oklahoma.

L. G. Barnett, Jr., D. W. Jeffrey, and **X. B. Reed, Jr.,** chemical engineers, have joined Humble Oil & Refining Co.'s research and development division at Baytown, Tex.

Jim Plumstead, head of Esso Research & Engineering Co.'s petrochemical section, design engineering department, has been appointed engineering associate and assigned to the company's European office in The Hague. **Bill Bray** will succeed Plumstead. **Len Hollander** has been named head of the department's equipment-development section.

Seaton L. Hunter, assistant research director in Monsanto Chemical Co.'s plastics division plant at Texas City, has been promoted to an associate research director. **Byron L. Williams** and **Robert E. Cairns,** section leaders in the research department, have been named assistant research directors. **David W. McDonald,** group leader, has been named a section leader, research department. **Robert G. Roth,** an assistant group leader, has been promoted to group leader. **Shaffer E. Horne,** formerly with Victoria Chemical Corp., has joined the research department, plastics division, at Texas City.

John V. Gannon, assistant district petroleum engineer for The Texas Co. in Midland, Tex., has been promoted to district petroleum engineer. He succeeds **V. F. Dullnig,** who recently was promoted to assistant division petroleum engineer. **B. D. Buthman,** geologist in the Midland office, has been promoted to Roswell, N. M., district geologist. He succeeds **H. S. Lain,** who has resigned to join Cosden Petroleum Corp. (OGJ, Feb. 2, p. 149). Texaco has enlarged its geological organization in Midland by splitting the former Midland geological district into North and South Midland districts. **Tom Hambleton,** geologist in Midland, becomes district geologist in the new North Midland district. **W. E. Russell,** geologist in Farmington, N. M., will be South Midland district geologist. **W. J. Vaughn,** district geologist in the old Midland district, is now assistant division geologist in Fort Worth.

W. J. Carthaus, Great Northern Oil Co., St. Paul, has been elected president of the Western Petroleum Refiners Association. He succeeds **Harry J. Kennedy,** Continental Oil Co., Houston. Newly elected WPRA vice presidents are **C. C. Tate,** Phillips Petroleum Co., Bartlesville, Okla., and **J. Porter Langfitt,** Pure Oil Co., Chicago. Reelected vice presidents were **Rexford S. Blazer,** Ashland Oil & Refining Co., Ashland, Ky.; **Walter Famariss, Jr.,** Famariss Oil & Refining Co., Hobbs, N. M.; and **Jack A. Vickers,** Vickers Petroleum Co., Wichita.

CARTHAUS

J. L. Severson, district exploration superintendent at Bismarck, N. D., for Pan American Petroleum Corp., has been transferred to Casper, Wyo., as division geologist. **R. S. Tremaine,** division geologist in Casper, has moved to Houston as division geologist. **B. G. Newton,** Bismarck district geologist, has been named supervisor in charge of the Bismarck district. In other exploration department changes, **J. L. Mataya,** Midland, Tex., district geophysicist, has been transferred to Calgary in the same capacity. **W. C. Wagner,** district geophysicist, has moved to Jackson, Miss., from Shreveport, La. **M. A. Knock** has been transferred from Lafayette, La., to Edmonton and named North Canadian district geophysicist.

T. S. Green, Geo Prospectors, Inc., and **S. E. Giulio,** Jersey Production Research Co., have been nominated for 1959-1960 president of the Geophysical Society of Tulsa. Officers will be chosen by mail ballot and will be installed May 14. Other candidates are, for first vice president, **William Doty,** Continental Oil Co., and **James E. Hawkins,** Seismograph Service Corp.; for second vice president, **Phil H. Garrison,** Pan American Petroleum Corp., and **C. A. Wood,** Shell Oil Co.; for secretary, **S. T. Algermissen,** Sinclair Research Laboratories, Inc., and **B. L. Bass,** The Texas Co. Candidates for treasurer are **Robert B. Fisher,** Davis Equipment Co., and **S. E. Elliott,** Phillips Petroleum Co.; for editor, **H. M. Zenor,** University of Tulsa, and **Joseph F. Mifsud,** Jersey Production Research.

▶▶▶ Personals

Kent Manning, manager of Venezuelan Gulf Refining Co.'s La Cruz refinery, has been transferred to Gulf's headquarters in Pittsburgh. **Tip Parks** will succeed Manning in Venezuela.

Cities Service Oil Co. has named eight regional sales managers in a realignment of marketing territory. The new managers are **C. W. Stark,** Cleveland; **G. E. Kohler,** South Bend, Ind.; **J. M. Ross,** Chicago; **P. R. Shay,** Milwaukee; **P. L. Miller,** St. Paul; **V. W. Johnson,** Des Moines; **R. R. Chastain,** Kansas City, and **G. A. Ward,** St. Louis.

E. J. Wacker, Jr., assistant vice president of Magnolia Petroleum Co., and **L. E. Frensley,** comptroller, have been named vice presidents.

Harold A. Weinland, intermediate petroleum engineer for Sinclair Oil & Gas Co., has been transferred to Drumright, Okla., from Seminole, Okla. **A. F. Bayazeed,** junior petroleum engineer, has moved to Carmi, Ill., from Nowata, Okla.

Eric N. Avery, former managing director of Shell companies in Australia, has been appointed managing director of Associated Freney Oil Fields and Associated Australian Oilfields. **Clive W. Smith** has joined the same companies as director.

Karl E. Gorham, district foreman in Ohio Fuel Gas Co.'s southern production division, has been promoted to superintendent of the division. Gorham will be in charge of the company's field activities in production and underground storage in 14 southeastern Ohio counties.

Alfonso Romero, general manager of Yacimientos Petroliferos Fiscales Bolivianos, government-owned oil agency, has been elected president of the newly formed Bolivian Petroleum Institute. Other officers are **Benjamin Hake,** Bolivian Gulf Oil Co., vice president; **Enrique Mariaca,** YPFB, secretary; and **Fernando Ortiz,** Cia. Petrolera Boliviana Shell, Ltd., treasurer.

Oil's Grand Old Men Will Be Chosen Soon

ONLY ONE WEEK remains for nomination of the oil industry's top ranking Old Timers, to be honored at the International Petroleum Exposition in May at Tulsa.

Nominations may be made by anyone, including a nominee himself, and must be received by March 31.

Candidates for the "Pioneer of Pioneers" award must have at least 50 years' service in the oil industry.

The other seven Grand Old Men must have had 40 years or more of active service in the field of pipeline and transportation, supplies and equipment, drilling, production, natural gasoline, natural gas, or refining.

W. J. Sherry

About 150 nominations have been received by William J. Sherry, chairman of the Old Timers committee.

Winner of the Pioneer of Pioneers award will be named for age, length of service, and contribution to the industry. Age, service and contribution to the particular branch of the oil business from which he is nominated will be considered in naming the other Grand Old Men.

Nominees for any Grand Old Man award automatically becomes candidates and will be considered for the Pioneer of Pioneers award if they qualify.

Awards will be presented May 17 on the IPE grounds near the replica of the Drake Well. The Old Timers headquarters is nearby. Sherry said all veteran oil men will register there and receive a gold lapel pin.

Sherry also was head of the committee for the 1953 oil show.

Those receiving Old Timer awards then were:

W. L. Connelly, production; W. R. Finney, pipeline and transportation; Dr. Godfrey L. Cabot, natural gas; Dr. George G. Oberfell, natural gasoline; Wallace D. Wilson, supplies and equipment; the late Harry J. Crawford, pioneer of pioneers, and the late Edwin B. Reeser, refining.

Your Last Chance To Help Select

GRAND OLD MEN of the OIL INDUSTRY

I nominate .....,

Whose address is .....,

For the International Petroleum Exposition award checked below:

_____ **Pioneer of Pioneers**

_____ **Grand Old Man of Pipeline and Transportation**

_____ **Grand Old Man of Refining**

_____ **Grand Old Man of Supplies and Equipment**

_____ **Grand Old Man of Drilling**

_____ **Grand Old Man of Production**

_____ **Grand Old Man of Natural Gasoline**

_____ **Grand Old Man of Natural Gas**

My Name .....

Address .....

(Please attach a sheet giving additional information.)

Mail before March 31 to: William J. Sherry, Chairman
IPE Old Timers Committee
Box 5205
Tulsa, Okla.

L. T. Wilson, director of refining and supplies for Cia. Shell de Venezuela, Ltd., has been named manager of Montreal refinery of Shell Oil Co. of Canada, Ltd. He will succeed **J. L. Miller,** who will retire this summer. **Bruno Stolley,** formerly on assignment with Bataafsche Petroleum Mij.

WILSON

STOLLEY

in The Hague, will succeed Wilson. Wilson will be returning to the Montreal refinery post which he held for a year before moving to Venezuela in 1956. Stolley had been manager of laboratories at Shell's Emeryville, Calif., research center and manager of the Martinez refinery before assignment with BPM.

Wayne E. Swearingen, vice president and chief engineer for Alex W. McCoy Associates, has resigned to form Swearingen Engineering Co., Tulsa consulting firm. He had been with McCoy since 1956.

L. A. Kuebler, former Houston district geologist for The Texas Co., has been promoted to assistant division geologist in Houston. The former Houston district area has been divided into two districts east and west of Houston. **Ralph A. Davis** and **Morris W. Wylie** has been appointed district geologists of these areas. **Claud M. Watts** has been named development geologist, Houston division, succeeding Davis.

W. H. Hunt, Hunt Oil Co., Dallas, has been named chairman of the Rocky Mountain subcommittee of Oil Industry Conservation Forum. The group is studying methods for cutting production costs. Other members of the subcommittee are **C. L. Larson, Jr.,** Pan American Petroleum Corp., Casper, Wyo.; **Cedric Boone,** Amerada Petroleum Corp., Tulsa; **H. B. Gernert,** Trigood Oil Co., Casper; **Arch Bell,** Gulf Oil Corp., Denver; **J. R. Dorrough,** Carter Oil Co., Billings, Mont.; **W. T. Blackburn,** Vaughey & Vaughey, Denver; **H. A. True, Jr.,** True Drilling Co., Casper; **John W. Gee,** Ohio Oil Co., Casper; **W. A. Alexander,** Shell Oil Co., Denver; and **J. L. Dougan,** Equity Oil Co., Salt Lake City.

James N. McCoy, formerly with Gulf Oil Corp., has joined Cable & Stevens, Wichita Falls, Tex., as petroleum engineer.

Fred W. Argue, vice president and engineering manager for Stone & Webster Engineering Corp., has been elected executive vice president.

W. J. Wallace, drilling supervisor in Brookhaven, Miss., for The California Co., has been named area foreman in Cranfield, Miss. He succeeds the late P. F. Holmes.

Harold Owen, senior process engineer in Continental Oil Co.'s manufacturing department, Ponca City, Okla., has been named assistant regional superintendent of natural gasoline operations in Fort Worth.

Gene A. Smitherman, formerly senior petroleum engineer in Tennessee Gas Transmission Co.'s Gulf Coast production division, has opened consulting offices in Houston. A graduate of the University of Texas and South Texas Law School, Smitherman was with Sinclair Oil & Gas Co. at one time.

Charles R. Halstead, British-American Oil Producing Co., has been elected 1959-60 president of East Texas Geological Society, Tyler, Tex. He succeeds **Thomas H. Walker,** Magnolia Petroleum Co. Other new officers are **Paul H. Nichols,** Shell Oil Co., vice president; **Francis Daly,** Tidewater Oil Co., secretary; and **Leo R. Chisholm,** Amerada Petroleum Corp. treasurer. **Tom Patrick,** Atlantic Refining Co., is executive committeeman.

▶▶▶ Personals

W. S. Day, Michigan district manager for Dowell division of Dow Chemical Co., has retired after 26 years with the company.

John F. West, formerly geologist with Lion Oil Co. division of Monsanto Chemical Co. in Oklahoma City, has resigned to open consulting offices in Tulsa.

L. W. (Bill) Goudy has been named assistant exploration manager of Vickers Petroleum Co. He will continue as chief geologist.

P. A. Bazemore, head of Creole Petroleum Corp.'s Tia Juana, Venezuela, gas group, has retired after 25 years with the company.

Richard L. Porter, Sinclair Oil & Gas Co.'s district land manager at New Orleans, has been transferred to Anchorage as district land manager in the company's new exploration office there. **Ross Roger Gahring** and **Fred B. Jones, Jr.,** both formerly senior geologists at the Ardmore, Okla., district office, have been transferred to Anchorage.

Herman Ninemire, production foreman in Rayne, La., for Continental Oil Co., has been named senior production foreman in Eunice, La. **Joe Bridges,** plant foreman in Yorktown, Tex., has been transferred to Flatonia, Tex., as production foreman. **Donald Cave,** Griffin, Ind., production foreman, has moved to Mount Carmel, Ill., in the same capacity.

▶▶▶ Deaths

Charles B. Goddard, 78, Ardmore, Okla., oil man, died March 11 in a Temple, Tex., hospital after undergoing surgery March 7. Goddard was superintendent of Humble Oil & Refining Co.'s Oklahoma division and a director of the company at one time. He left Humble to form Goddard Oil Co. in 1929. He was a member of the Oklahoma Hall of Fame.

Sigel Benson, production superintendent for Bandini Petroleum Co. since 1953, was killed in an auto accident March 11 near King City, Calif.

Walter L. Dobie, 70, El Dorado, Ark., engineer on the staff of the Arkansas Oil and Gas Commission, died March 11 in a New Orleans hospital. Dobie and his brother, the late Leslie L. Dobie, were co-owners of Dobie Oil Co., Tulsa, during the 1920's. He was a graduate of Missouri School of Mines.

Charles W. King, 65, retired independent operator, died March 13 at his home near Glencoe, Okla., after a heart attack.

Harry D. Frueauff, 82, retired Cities Service executive, died March 16 in New York. He had held many posts in the Cities Service organization including that of vice president of Cities Service Petroleum and vice president of Cities Service Oil Co. He was a director of the American Petroleum Institute for many years.

Imports plan can promote refinery runs

BY JOHN C. CASPER

REFINERS will have to keep a closer watch on operating statistics this year than in the past. Industry profits will be tied closer to product stock levels than in recent years.

The change has come about through the new plan to allocate crude imports, based on refinery runs. In some cases this method of distributing imported crude may add another incentive for increased crude runs.

Allocation of imported crude to refiners will be reviewed twice a year. Total volume of crude to be imported into this country will depend on expected demand for crude and products, but the quota for an individual refiner will be related to the volume of crude he ran during the base period.

This means that while higher runs will not boost total crude imports, it may be possible for a refiner to increase his portion of the total by processing more crude.

As long as there is a price differential in favor of foreign crude, there will be a profit incentive to use more imported oil. If a refiner decides that he may be able to increase his allocation of imported crude by increasing refinery throughput, he will start looking for a place to sell the extra products from his expanded operations.

If only a few refiners try such a plan, they may be able to sell the surplus output at only slight discounts off their normal price schedule. In this case increased runs would be profitable. The small loss in selling price would be offset by increased allocation of lower-priced crude. The lure of higher crude-import quotas is an added attraction over and above the temptation of the incremental barrel. If too many refiners try the plan the results will be disastrous.

Every refiner can predict the outcome of overproduction and excessive product inventories. The end result always has been lower prices and decreased refinery realization in addition to the extra cost of storing surplus products.

The chart below shows the periods of high product stocks since the end of World War II and calls attention to the influence of stock levels on prices. Refined product stocks are expressed as days' supply.

There have been three peaks for product stocks since the end of the war. The first came in 1949, followed by another in 1954. The most recent buildup was in 1957 and 1958. Most of the 1958 surplus was worked off before the end of the year but not until prices had been pulled down.

During the buildup period before each of these peaks, some refiners admitted and warned that refinery runs were too high. But, the corrective reduction in runs did not come until low prices and reduced refinery realization forced a cutback in operations.

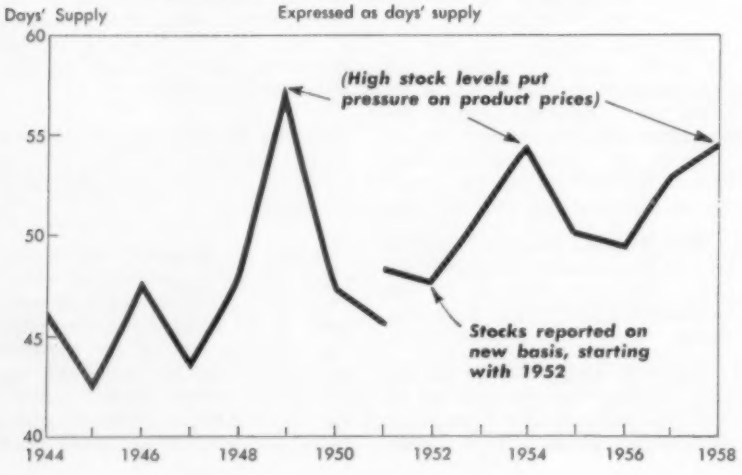
This is the season for reductions in crude input at refineries. The high-demand winter season is over. Peak gasoline demand is about 4 months away. Gasoline prices have been abnormally low during the winter months but have strengthened some in the past few weeks. Reasonable prices for this summer's output will depend on refinery runs between now and the end of April.

The markets . . . Gasoline prices are starting to move up from the depressed levels of recent months. Adjustments have been reported in several New England cities. Standard Oil Co. (Ind.) announced increases in tank-wagon prices in four North-Central states. Group 3 prices are slightly higher, and increased sales are adding strength on the Gulf Coast.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,137,332	DOWN	74,221	UP	903,230
Crude stocks	256,001,000	DOWN	3,119,000	DOWN	30,084,000
Completions	838	DOWN	22	UP	5
Refinery runs	8,283,000	UP	76,000	UP	804,000
Gasoline stocks	210,290,000	UP	3,275,000	DOWN	6,235,000
Kerosine stocks	18,988,000	UP	3,000	UP	1,529,000
Distillate stocks	78,876,000	DOWN	1,740,000	DOWN	2,977,000
Residual stocks	55,010,000	UP	175,000	DOWN	51,000
Four-product stocks	363,164,000	UP	1,713,000	DOWN	7,734,000
Total imports	1,737,900	DOWN	881,900	UP	205,400

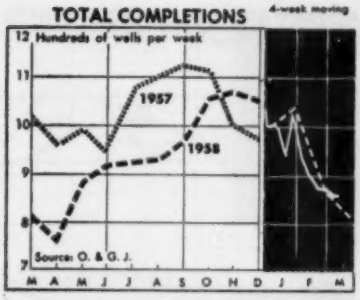
REFINED-PRODUCT STOCKS

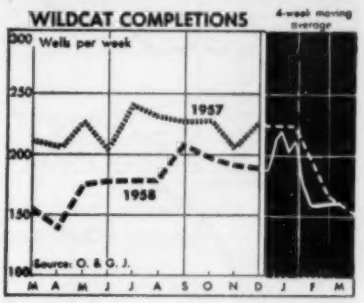


Active Rotary Rigs *

	3-16-59	3-9-59	3-17-58
Alabama	7	8	5
Arkansas	19	13	20
Arizona	0	0	0
California	94	87	80
Land	91	85	(†)
Offshore	3	2	(†)
Colorado	27	29	27
Florida	2	2	1
Illinois	14	12	15
Indiana	4	4	1
Iowa	3	3	3
Kansas	124	126	71
Kentucky	4	3	1
Louisiana	301	296	327
North	28	21	29
S.-Inland waters	134	142	(‡)
S.-Land	99	98	237
Offshore	40	35	61
Maryland	1	1	0
Michigan	17	20	7
Mississippi	59	61	34
Missouri	0	0	0
Montana	17	18	21
Nebraska	23	22	12
Nevada	0	0	0
New Mexico	93	95	109
New York	0	0	1
North Dakota	36	37	33
Ohio	1	3	0
Oklahoma	217	199	132
Oregon	0	0	0
Pennsylvania	13	13	12
South Dakota	1	1	0
Texas	725	698	699
S.-Inland waters	6	8	(‡)
S-Land	156	124	156
Offshore	1	1	3
North-East	156	147	(†)
West Central	252	252	(†)
West	154	166	(†)
Utah	35	40	38
Washington	0	0	2
West Virginia	5	4	4
Wyoming	53	52	39
Total U. S.	1,895	1,847	1,694
Western Canada	215	226	208
Eastern Canada	0	0	1
Grand total	2,110	2,073	1,903

*Hughes Tool Co. †Comparisons not available due to change in method of reporting. ‡Included in South-Land.



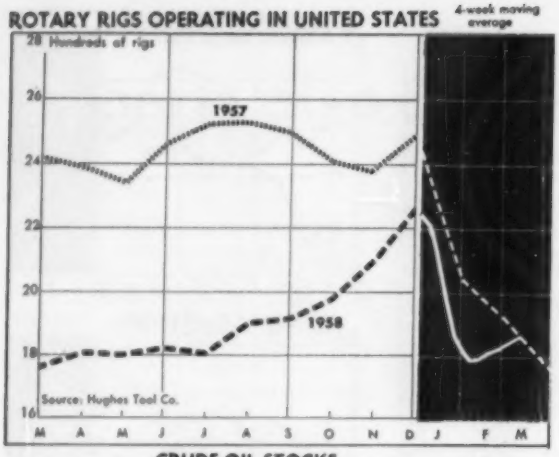


WEEKLY WELL COMPLETIONS . . . WEEK ENDED MARCH 14, 1959

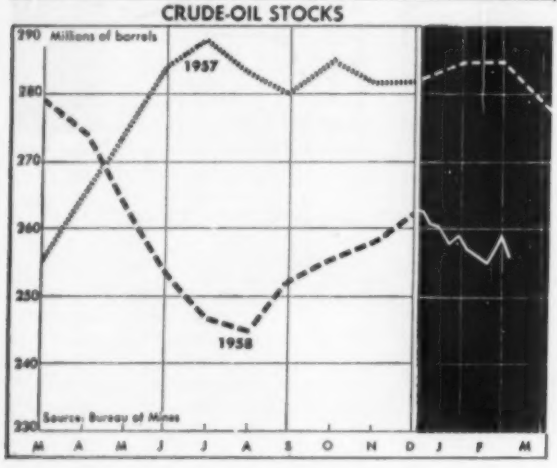
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1959	1958	Total	Crude	Cond.	Gas	Dry	1959	1958
Alabama	2	2	0	0	0	0	23,096	25	15	0	0	0	0	0	4	6
Arkansas	16	6	0	2	6	2	59,624	196	139	3	0	0	0	3	35	30
California	23	15	0	0	8	0	125,236	324	434	3	0	0	0	3	74	78
Colorado	21	4	0	0	17	0	87,442	157	160	13	1	0	0	12	84	87
Illinois	31	16	0	0	13	2	80,692	135	153	1	1	0	0	0	41	55
Indiana	10	7	0	0	3	0	18,167	455	418	4	1	0	0	3	73	78
Kansas	73	26	0	2	43	2	257,569	815	850	21	4	0	0	17	191	172
Kentucky	25	13	0	6	6	0	59,629	366	173	1	0	0	0	1	42	24
Louisiana	65	38	6	3	18	0	526,658	747	686	7	1	0	0	6	106	83
North	22	14	0	2	6	0	73,844	272	251	3	1	0	0	2	51	34
South	31	17	6	0	8	0	331,503	392	343	3	0	0	0	3	53	45
Offshore	12	7	0	1	4	0	121,311	83	92	1	0	0	0	1	2	4
Michigan	9	5	0	1	3	0	27,279	115	64	2	0	0	0	2	36	25
Mississippi	13	8	0	0	5	0	102,771	131	85	4	0	0	0	4	62	47
Montana	2	1	0	0	1	0	14,824	57	85	1	0	0	0	1	24	40
Nebraska	15	6	0	0	9	0	87,406	141	142	6	2	0	0	4	64	70
New Mexico	39	29	1	4	5	0	192,839	353	470	5	1	0	0	4	36	68
New York	0	0	0	0	0	0	0	74	111	0	0	0	0	0	4	9
North Dakota	8	6	0	0	2	0	53,973	88	91	2	0	0	0	2	23	34
Ohio	27	11	0	10	6	0	81,800	182	183	1	0	0	0	1	5	3
Oklahoma	102	41	3	8	45	5	407,701	1,176	1,510	21	2	0	0	19	191	212
Pennsylvania	0	0	0	0	0	0	0	59	16	0	0	0	0	0	1	1
Texas	328	183	13	9	103	20	1,292,322	3,783	3,901	57	3	4	0	50	716	831
Dist. 1	14	4	1	0	9	0	40,529	242	194	5	0	0	0	5	64	77
Dist. 2	10	4	0	1	5	0	54,854	152	121	2	0	0	0	2	46	33
Dist. 3	16	7	4	0	5	0	114,314	222	262	4	0	2	0	2	65	45
Dist. 4	14	6	1	0	7	0	96,656	266	242	7	0	1	0	6	77	79
East	14	5	1	0	7	1	67,481	225	282	4	0	0	0	4	54	82
Dist. 7-B	60	32	0	1	25	2	134,141	491	465	8	0	0	0	8	134	147
West	105	68	3	0	23	11	498,166	1,193	1,188	13	0	0	0	13	129	190
Dist. 9	64	40	0	2	18	4	167,417	718	852	11	3	0	0	8	118	154
Dist. 10	31	17	3	5	4	2	118,764	280	295	3	0	1	0	2	29	24
Utah	7	7	0	0	0	0	40,349	78	101	0	0	0	0	0	18	17
West Virginia	16	0	0	15	1	0	35,497	149	156	0	0	0	0	0	5	6
Wyoming	5	2	0	0	3	0	14,012	173	178	1	0	0	0	1	67	64
Misc. (Ariz.)	1	0	0	0	1	0	1,945	15	28	1	0	0	0	1	12	22
Total U. S.	838	426	23	60	298	31	3,590,831	9,794	10,149	154	16	4	0	134	1,914	2,062
Prev. week	860	455	27	46	309	23	3,735,243	.....	.....	163	17	2	8	136	.....	.....
Cum. 1959	9,794	4,949	255	656	3,670	264	41,497,836	.....	.....	1,914	205	26	65	1,618	.....	.....
Western Canada	50	29	0	3	18	0	261,102	475	517	16	1	0	1	14	178	183

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	3-7-59	2-28-59	3-8-58
Pennsylvania	2,507	2,522	2,910
Other Appalachian	1,556	1,333	1,512
Illinois, Indiana, Michigan	8,741	9,722	10,879
Nebraska and North Dakota	2,158	2,228	2,365
Kansas	8,822	8,913	9,216
Oklahoma	15,674	16,196	18,513
Arkansas	1,933	1,967	2,875
Louisiana	17,702	17,988	20,097
North	2,885	2,882	3,480
South	14,817	15,106	16,617
Mississippi, Alabama, Florida	2,541	2,366	2,423
New Mexico	8,741	9,062	8,343
Texas	112,938	115,384	128,347
East Texas	8,916	9,252	9,127
West Texas	55,425	56,183	55,682
Texas Gulf	19,612	19,964	27,810
Other Texas	28,985	29,985	35,728
Wyoming	13,042	12,776	15,266
Other Rocky Mountain	9,132	9,182	7,062
California	35,044	34,676	39,274
Foreign	†15,470	14,805	17,003
Total	**256,001**	259,120	286,085

*Bureau of Mines. ‡Includes 5,282,000 bbl. in California.

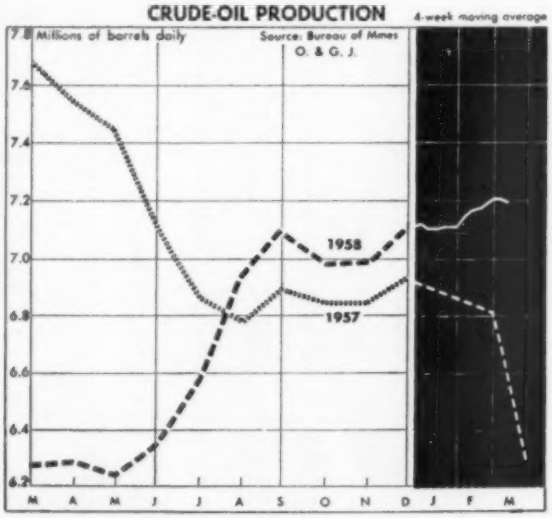
DAILY AVERAGE PRODUCTION FOR WEEK

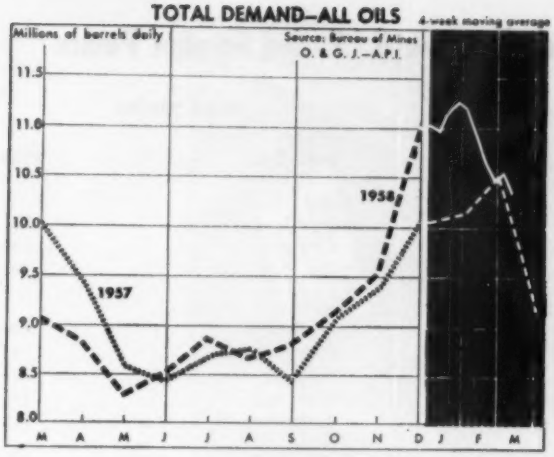
	March 14, 1959			March 7
	Crude oil	Lease condensate	Total	total
Alabama	16,300	.....	16,300	16,228
Arkansas	79,600	200	79,800	79,700
California	841,200	.....	841,200	842,000
Colorado	128,900	.....	128,900	128,700
Eastern	41,800	.....	41,800	40,200
Florida	1,175	.....	1,175	1,175
Illinois	233,500	.....	233,500	328,300
Indiana	31,400	.....	31,400	33,700
Kansas	†307,532	.....	†307,532	†335,600
Kentucky	67,300	.....	67,300	67,000
Louisiana	850,500	109,050	959,550	959,475
North	112,000	4,050	116,050	115,975
South	738,500	105,000	843,500	843,500
Michigan	22,700	.....	22,700	22,800
Mississippi	116,800	5,250	122,050	122,050
Montana	80,500	.....	80,500	78,800
Nebraska	59,400	.....	59,400	59,600
Nevada	100	.....	100	100
New Mexico	287,000	6,000	293,000	293,000
North Dakota	40,300	.....	40,300	37,700
Oklahoma	†539,400	.....	†539,400	†569,600
Texas	2,773,000	73,300	2,846,300	2,846,300
Dist. 1	43,000	3,200	46,200	46,200
Dist. 2	118,000	8,400	126,400	126,400
Dist. 3	373,000	34,400	407,000	407,000
Dist. 4	200,000	9,000	209,000	209,000
Dist. 5	32,000	400	32,400	32,400
Dist. 6	123,000	7,600	130,600	130,600
East Texas Field	159,000	.....	159,000	159,000
Dist. 7-B	145,000	150	145,150	145,150
Dist. 7-C	133,000	3,650	136,650	136,650
Dist. 8	1,134,000	3,300	1,137,300	1,137,300
Dist. 9	206,000	2,200	208,200	208,200
Dist. 10	107,000	1,000	108,000	108,000
Utah	86,000	.....	86,000	112,500
Wyoming	339,000	.....	339,000	336,900
Others	‡125	.....	‡125	‡125
Total U. S.	6,943,532	193,800	**7,137,332**	7,211,553
Change from prev. week, down			**74,220**	
Canada	†521,200	.....	†521,200	†528,000

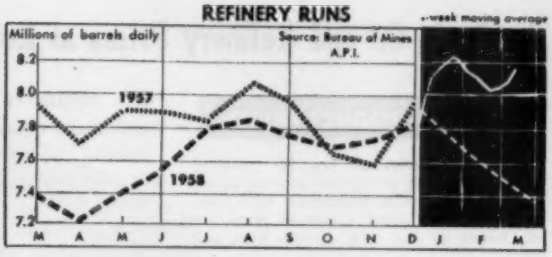
Total U.S. production—Jan. 1-March 14 ..... 522,895,550 bbl.
Same period last year (crude plus cond.) ..... *491,664,860 bbl.

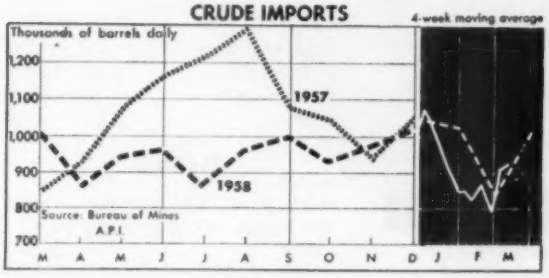
*Includes 12,014,175 bbl. condensate. †Week ended previous Monday. ‡Includes South Dakota and Washington.

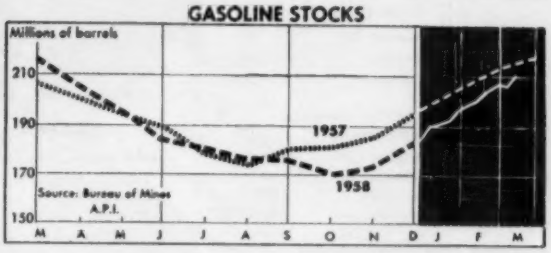
CRUDE-OIL PRODUCTION

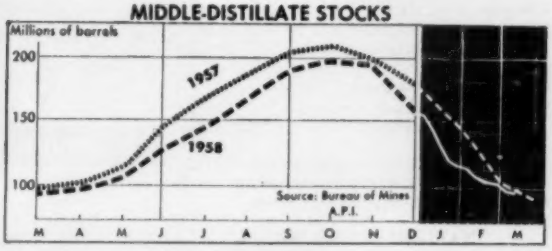


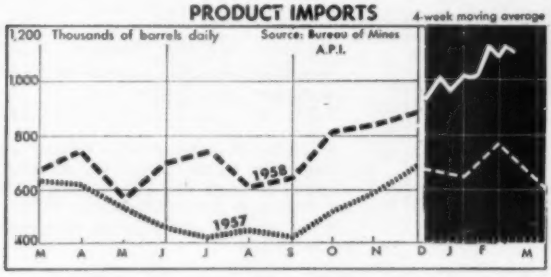

TOTAL DEMAND—ALL OILS
4-week moving average
Millions of barrels daily
Source: Bureau of Mines
O. & G. J.—A.P.I.
1957
1958
M A M J J A S O N D J F M

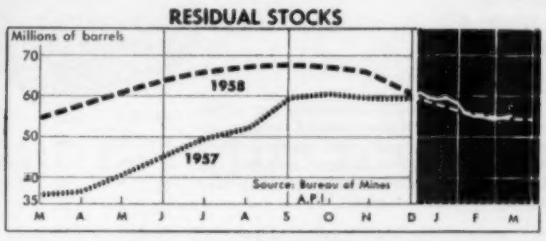












API REFINERY REPORT, MARCH 13, 1959

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, March 1958—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,224	520.7	56.7	371.1	183.1	45,985	8,726	27,921	12,405	1,126.3	468.7	36.1	299.7	204.0
Appalachian:														
District 1	104	41.8	4.7	22.1	8.4	4,892	408	1,832	222	92.2	39.0	5.1	23.6	9.8
District 2	103	50.0	9.2	15.6	21.6	2,862	285	777	275	105.5	46.7	6.9	21.5	12.0
Ind., Ill., Ky.	1,521	734.0	81.4	342.0	186.2	37,797	3,427	11,275	3,199	1,358.2	681.0	80.1	286.9	169.1
Minn., Wis., Dak.	106	55.0	7.4	24.7	12.7	6,644	530	3,294	417	96.4	42.1	4.5	26.7	12.9
Okla., Kans., Mo.	750	399.3	20.3	191.1	32.1	22,659	857	6,495	891	627.0	340.0	13.0	160.5	30.3
Inland Texas	290	199.3	8.3	51.3	21.7	8,479	334	1,337	2,133	247.9	182.2	9.0	46.1	21.0
Texas Gulf Coast	1,963	926.3	87.4	522.3	208.0	27,252	1,775	8,017	5,219	1,715.5	813.3	108.6	437.9	184.7
La. Gulf Coast	665	375.4	45.2	192.3	46.0	11,848	1,513	4,151	1,417	600.1	335.9	59.8	133.9	45.0
N. La. and Ark.	102	44.7	5.1	24.3	6.6	4,766	546	1,275	77	101.0	46.4	6.5	21.0	8.9
Rocky Mountain:														
New Mexico	23	12.4	0.1	3.0	2.7	726	31	177	23	16.8	7.3	0.2	3.4	2.8
Other Rky. Mt.	307	144.6	3.5	79.3	37.6	7,286	197	2,435	887	237.4	115.1	1.1	56.0	28.4
West Coast	1,125	543.9	1.3	187.9	281.0	29,094	359	9,890	27,845	1,032.2	467.9	5.7	132.8	286.2
Mar. 13, 1959	8,283	4,047.4	330.7	2,027.0	1,047.7	210,290	18,988	78,876	55,010	7,356.5	3,585.6	336.6	1,650.0	1,015.1
Mar. 6, 1959	8,207	3,923.0	341.9	2,157.6	1,071.4	207,015	18,985	80,616	54,835	.....	.....	.....	.....	.....
Mar. 14, 1958	7,479	3,669.6	384.7	1,698.7	1,023.0	216,525	17,459	81,853	55,061	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
★ Regular (89 octane)	11.625-12.00
★ Premium (99 octane)	14.625-15.00
Gulf Coast (cargoes for coastwise or export movements):	
★ Regular (90 octane)	10.00-10.25
★ Regular (92 octane)	10.25-10.50
★ Premium (97 octane)	11.375-11.75
★ Premium (98 octane)	11.50-11.75
California (rack) (Los Angeles):	
★ Regular (88 octane)	12.65
★ Premium (94 octane)	13.65
★ Premium (98 octane)	14.65
Caribbean area (cargoes):	
Regular (87 octane)	9.875
Premium (97 octane)	11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100%, prices for lower-vapor-pressure grades increase 2.5% for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	10.75-11.00
Diesel oil (58 d.i. and above)	10.50-10.75
Distillate No. 1	10.50-10.75
Distillate No. 2	9.75-10.00
Gulf Coast (cargoes):	
Kerosine 41-43	10.375
Distillate No. 2	9.875
New York Harbor (barges):	
Kerosine 41-43	11.50
Distillate No. 2	11.00
Diesel fuel, 48-52 d.i.	11.25
Caribbean area (cargoes):	
Distillate No. 2	9.875

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank car	6.50
New York (export):	
126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.00-2.05
Gulf Coast (cargoes):	
Bunker C fuel	$2.00
New York Harbor (barges):	
Bunker C fuel	$2.37
Caribbean (cargoes):	
Bunker C	$2.00
California (rack):	
Bunker C fuel, Los Angeles	$2.15

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 pp., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 pp., 95 v.i.	20.5
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	22
200 vis. neutral (180° at 100°), 25 p.t.	21

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$1.86	....	....	....	....
15-15.9	1.95	....	....	....	$1.81
16-16.9	2.04	....	....	....	1.86
17-17.9	2.13	....	....	....	1.91
18-18.9	2.23	....	....	....	1.96
19-19.9	2.32	....	....	....	2.01
20-20.9	2.41	$2.49	....	$2.35	2.06
21-21.9	2.50	2.52	....	2.38	2.11
22-22.9	2.60	2.55	....	2.41	2.16
23-23.9	2.69	2.58	$3.44	2.44	2.21
24-24.9	2.78	2.61	3.46	2.47	2.26
25-25.9	2.84	2.64	3.48	2.50	2.31
26-26.9	2.90	2.67	3.50	2.53	2.36
27-27.9	2.95	2.70	3.52	2.56	2.49
28-28.9	3.01	2.73	3.54	2.59	2.54
29-29.9	3.07	2.76	3.56	2.62	2.59
30-30.9	3.12	2.79	....	2.65	2.63
31-31.9	3.20	2.82	....	2.68	2.67
32-32.9	3.27	2.85	....	2.71	2.71
33-33.9	3.34	2.88	....	2.74	2.75
34-34.9	3.41	2.91	....	2.77	2.79
35-35.9	3.47	2.94	....	2.80	2.83
36-36.9	3.52	2.97	....	2.83	2.87
37-37.9	3.56	2.99	....	2.86	2.89
38-38.9	....	3.01	....	2.89	2.91
39-39.9	....	3.03	....	2.92	2.93
40-40.9	....	3.05	....	2.95	2.95

*Another Oklahoma (sweet) schedule has a top of $3.08 with gravity variations to $2.52 for below 20°. †Low cold test crude. ‡Sour.

Effective dates of broad changes: California, 1-26-59; East of California, January 3-10, 1957; Pennsylvania Grade 12-22-58.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.05
Middle District	3.87
Southwest Pennsylvania	3.58
West Virginia	3.40
Buckeye Grade	3.25
Illinois Basin	3.00
Canada:	
Leduc-Woodbend	2.67
Redwater (Alta.)	2.56
Smiley (Sask.)	2.33
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.51
San Joaquin, 41°-41.9°, Puerto La Cruz	3.25
Oficina, 35°-35.9°, Puerto La Cruz	2.90
Tia Juana medium, 26°-26.9°, Amuay*	2.40
Quiriquire, 16.0°-16.4°, Caripito	2.15
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.93

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

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PETROLEUM ENGINEER: Age 27. Have completed major company training program. B.S., University Wisconsin. Edward Mathews, 2521 No. 93rd St., Milwaukee, Wis.

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EQUIPMENT MEN ... in the news

Cordell Garner is guest speaker

... at a recent meeting of the National Association of Corrosion Engineers held in Calgary, Alberta, Canada. Garner is vice president in charge of sales of Plastic Applicators, Inc., Houston. In his speech, "Baked-on Plastic Coatings for Oil-Field Tubular Goods," Garner emphasized the increase in use of baked coating on pipes. The guest speaker gave details on research and field testing in various pipe coatings, and the effectiveness of each type coating in a given oil-field problem.

Dresser Mfg. Division names

... E. R. Carey assistant sales manager of regular products, announces Charles Kuhn, sales manager. John P. Lord, former business manager for welding fittings, will take Carey's place in general markets sales. Both men will headquarter at Dresser's Bradford, Pa., office.

Richard L. Spetka is promoted

... manager of power-engine sales of Cooper-Bessemer Corp., announces Grant C. Woodard, general sales manager. In this capacity, Spetka will head the company's sales engineering program on four-cycle engines for all stationary services.

Spetka fills the post formerly held by Frank L. Friedli who now heads the sales efforts of the company's En-Tronics Controls Division. Spetka previously worked in C-B's New York domestic office.

Heach Sales Co. is appointed

... sales representative for B-I-F Industries, Inc., in B-I-F's Denver territory, which includes Southeast Wyoming, Colorado, and the Four Corners region.

Clovis F. Kendrick joins

... the Odessa, Tex., office of Hardy-Griffin Engineering Corp. as a sales engineer, reports Joe Safford, vice president and general manager. Kendrick formerly was a partner in Leitz Equipment Co., and earlier worked as sales representative for Hydril Co.

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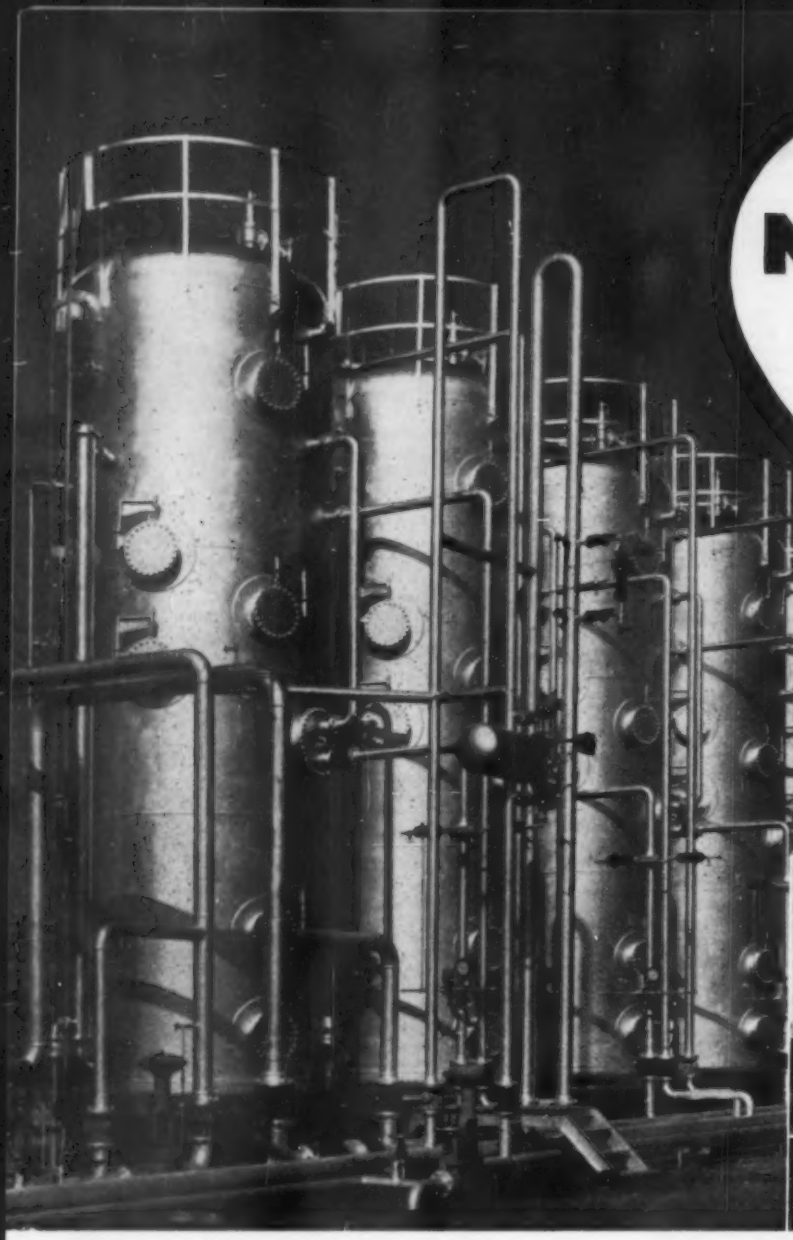

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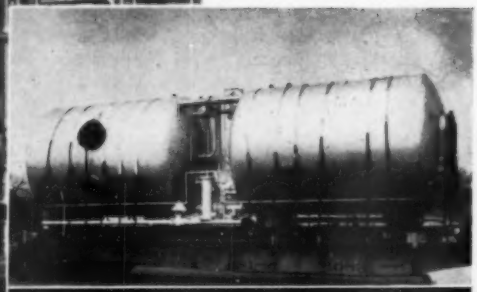

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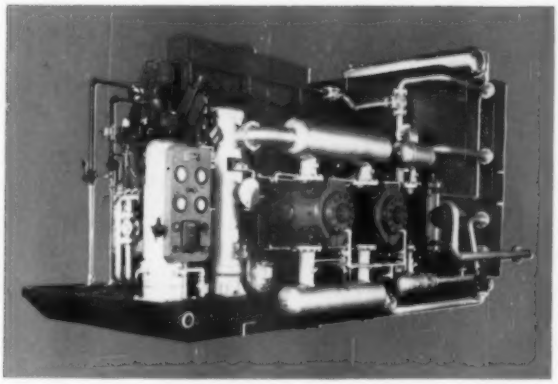
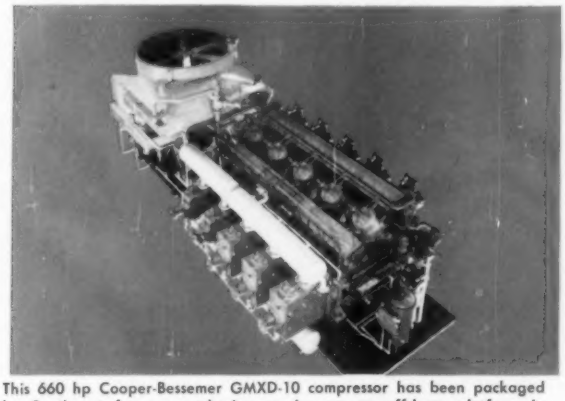
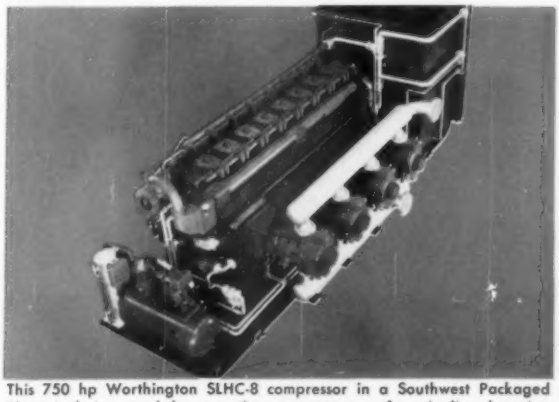


A 330 hp Ingersoll-Rand SYG-6 compressor, packaged by Southwest Industries, is in gas lift service in the swamps of Louisiana.



This 660 hp Cooper-Bessemer GMXD-10 compressor has been packaged by Southwest for gas gathering service on an offshore platform in South Louisiana.



This 750 hp Worthington SLHC-8 compressor in a Southwest Packaged Plant is being used by a major gas company for pipeline boosting in East Texas.

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